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ABSTRACT

Provided are solid waste/energy curriculum materials for grades K-2, 3-4, 5-6, 7-9, and 10-12. Separate folders containing units of study (focusing on trash, litter, and recycling) are provided for kindergarten (four units), grade 1 (two units), and grade 2 (two units). Folders contain teachers' directions and activity cards which include picture coloring, games, and multiple-choice questions for beginning and non-readers. Materials for grades 3-4 consist of three units focusing on people and garbage, recycling and re-use, and "litterly speaking" activities. Each unit consists of teacher-led activity cards. Materials for grades 5-6 consist of six units, each containing five to six student-directed task cards. Topic areas include trash disposal, recycling, energy, costs, and eco-action. Materials for grades 7-9 consist of four units containing five to six task cards. Topic areas include solid waste in history, hazardous wastes, landfills, and recycling. Ten envelope-style, self-explanatory, student-centered activities are provided for grades 10-12. These activities are designed for earth science, science (chemistry, physics, biology), biology, social studies/economics, and art teachers/classes. Teaching briefs (which include instructional strategies, background information, and other materials) are included. (JN)

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SOLID WASTE/ENERGY CURRICULUM

Produced by:

The Conservation and Environmental Studies Center, Inc.
120-13 Whitesbog Road
Browns Mills, New Jersey 08015

Supported by:

Burlington County NJ CETA

The Authors

V. Eugene Vivian, Project Director

Writing, Editing and Art Staff

Karl J. Brazauskas
Michele S. Byers
David C. Moore
Peter T. Mooney
Brian W. Petitt
David B. Snyder
Mark H. Wooden

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A THANK YOU TO THOSE WHO HAVE HELPED TO BRING THIS CURRICULUM TO YOU

DISSEMINATION

The Public School District of Medford, N.J., has served as the recipient for validation/dissemination Grant No. 82–117 in the Title IV C program of the Office of Evaluation of the N.J. State Department of Education.

Through this grant the curriculum was validated in grades 5 and 6, while continued testing was made in other grade levels. Teacher Training programs were also presented in eleven counties. Robert D. Elder, Director of Curriculum for the Medford Public Schools, served as director for this phase of the program.

PRINTING

Much of the original printing was produced and supported as a public service program by Burlington County CETA.

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All public school districts and private school administrations in Middlesex County have copies of this curriculum as a special service provided by the Middlesex County Department of Solid Waste Management Programs.

WRITING, ART AND EDITORIAL

Significant contributions to the editing for the original manuscript were made by Sarah McNeill-Orleans. Art work contributions were made by David Orleans and Betty Ann Kelly.

EVALUATION DESIGN

Dr. William A. Shabacher developed the research design, test instruments and statistical treatment utilizing pretest and post-test data.

FIELD TESTING

The following New Jersey school districts participated in pre-testing and post-testing to evaluate the effectiveness of the curriculum:

- Brick
- Cherry Hill
- Cinnaminson
- Eastampton
- Medford
- Moorestown
- Pemberton
- Plainfield
- South Brunswick
- Woodbury

SOLID WASTE/ENERGY CURRICULUM

TABLE OF CONTENTS

K-2 This consists of 40 activity cards in 3 units including picture coloring, games and multiple choice questions for beginning and non-readers. Skills in language arts and mathematics emphasized. The focus is on trash, litter and recycling. The folders contain teachers' directions for each grade.

K-Kindergarten: The Trash Tree
  Unit 1-The Classroom Trash Tree
    2-The Home Trash Tree
    3-The Let's Use it Again Tree
    4-What Do I Feel?

1-First Grade: Trash is Better Than Litter
  Unit 1-Everyone Makes Trash-Some People Make Litter
    2-All Trash Goes Somewhere

2-Second Grade: Recycling-Naturally
  Unit 1-Recycling Leaves
    2-Recycling Paper

3-4 This contains 3 units, each containing 4-5 Actions Cards directed to the students. The activities are teacher-led.

TEACHER BRIEFS FOR GRADES 3 AND 4

Unit A. PEOPLE AND GARBAGE
1. What's Garbage?
2. Who Makes Garbage?
3. Where Does Garbage Go? (A play to be read or performed by entire class)
4. Wasting Food
5. A Home Without a Garbage Truck?

Unit B. RECYCLING AND RE-USE
1. Reuse Your Trash
2. Exploring Recycling
3. Recycling Relay Game

Unit C. LITTERLY SPEAKING
1. Make a Litter Map
2. Litterbug Reporter
3. Litter Posters
4. Actions Speak Louder Than Words

5-6 This consists of 6 units, each containing 5-6 student directed task cards.

TEACHER BRIEFS FOR GRADES 5 AND 6

Unit A. WHAT DO WE THROW AWAY?
1. Dissect a Trashcan
2. Solid Wastes Were Once Part of The Earth
3. Who Makes Solid Wastes?
4. Litter and Litterbugs
5. Ouch!
6. How Much?

Unit B. WHERE DOES IT GO?
1. Open Dumps and Sanitary Landfills
2. Garbage to Ashes
3. Garbage to Soil
4. To Sea Or Not To Sea?
5. Caution: Air, Soil and Water At Stake!

Unit C. ONCE IS NOT ENOUGH
1. Natural Recycling in Soil and Water
2. Re-using Your School's Wastes
3. Recycling By Man
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5. Visiting a Recycling Center

Unit D. MANY FACES OF ENERGY
1. Energy Makes Things Go
2. An Energy Use Mural
3. Where Does the Energy We Use Come From?
4. How Energy is Changed to Make it Useful
5. Trashpower

Unit E. TRASH N' CASH
1. How Much to Move Your Trash?
2. Cleaning Up Your Block
3. Scrambled Eggs
4. Turning Trash Into Cash
5. Garbage Power

Unit F. ECO-ACTION
1. Make Trase Live Again
2. Start a Litter Campaign
3. Learning To See Litter
4. Take Pictures for a Litter Campaign
5. Write Letters for a Litter Campaign

7-9 This consists of 4 units, each containing 5-6 task cards.

TEACHER BRIEFS FOR GRADES 7, 8, 9

Unit A. SOLID WASTE IN HISTORY
1. Digging Up the Past
2. Ask Someone Who Remembers
3. Visiting an Antique Show
4. A Day in the Life Of
5. 1980's: What Lies Ahead?

Unit B. LANDFILLS
1. Introducing the Sanitary Landfill
2. Midnight Dumpers
3. Out of Space
4. What Good is an Old Landfill?
5. Everybody's Problem
6. Do You Know Where Your Trash Is?

Unit C. HAZARDOUS WASTES
1. Hazardous Waste Is...
2. Home Hazardous Wastes
3. Disposal Dilemma
4. Hazardous Wastes: Harmful or Healthy?
5. Lethal Litter-Who Pays?
6. What Can You Do?

Unit D. WHAT IF WE...?
1. Return to Returnables or Recycle Glass?
2. Source Separate?
3. Recycle Steel, Aluminum and Glass?
4. Burn Garbage for Energy?

10-12 This contains 10 envelope style student centered activities. The activities are designed for different subject teachers and classes. Each folder is designed to be self-explanatory.

EARTH SCIENCE
Leachate on the Rocks

CHEMISTRY-PHYSICS-BIOLOGY
Non-fuel Use of Oil
Resource Recovery

BIOLOGY
Visit a Wastewater Plant

SOCIAL STUDIES-ECONOMICS
Land That I Love
The Disposal Award
Source Separation
Getting Involved
School Recycling Project

ART
Junk Art

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Frank Flower
Roger Gutentag
William Hall
Louis Iozzi
Leonard Little
Emory Markovic
William Michalsky
Margaret Needham
William Shabacher
Mary Shell
Robert Simkins
Janice Szakaly
Noel Taylor
Mary Sue Topper
John Wright
Thomas Wurtenberger
Madelyn Yucht

SOLID WASTE/ENERGY CURRICULUM

TEACHER BRIEFS

INFORMATION JUST FOR YOU!

- -- *Why Teach About Solid Wastes?*
- -- *How To Use This Curriculum – Special Features*
- -- *What About?*
  - - *The Big Ideas*
  - - *Evaluation*
  - - *Grade Level Placement*
  - - *Answers to Questions and Numerical Problems*
  - - *Source Separation Programs*
  - - *Hazardous Wastes*

CONSERVATION AND ENVIRONMENTAL STUDIES CENTER, INC.

120-13 Whitesbog Road

Browns Mills, New Jersey 08015

Produced by a grant from Burlington County CETA

2311 Burlington - Mt. Holly Road

Burlington, New Jersey 08016

FOR PRIMARY TEACHERS – GRADES K. 1. 2

INFORMATION JUST FOR YOU

WHY TEACH ABOUT SOLID WASTES?

The specter of hazardous wastes frightens every community. We are all having more and more trouble throwing things away. Each year there is actually more to put in the waste can; and each year there seems to be less space available for disposal. Surprising amounts of energy are spent or lost with our present means of getting rid of wastes. The disposal of solid wastes is the hottest environmental problem today. Hazardous wastes are the scariest problem.

Here are some reasons why you might want to share some learning experiences about trash and garbage with your kids.

Landfills are closing up; we're running out of landfill space.

Trash/garbage collection costs more and more, taking an increasingly larger tax bite.

Litter is an increasingly overwhelming problem in today's society.

Everybody comes in contact with solid wastes daily.

There are excellent opportunities for drills with basic skills:

mathematics – counting, measurement, clocks, sets, addition, subtraction

group leadership and interaction

language arts – spelling, writing, word puzzle, vocabulary

art – colors, sketches, maze

values consideration – exploring the values of self and others

HOW TO USE THE CESC/CETA SOLID WASTE CURRICULUM SPECIAL FEATURES

You may be weary of seeing new curriculums and, even when you like them, wonder how you could possibly add anything more. Here's the good news about this curriculum:

It's designed as a take-it-or-leave-it curriculum. You may use as few as one lesson/activity or as many as you like. It's open ended.

We anticipate that you may wish to reproduce parts of the curriculum. You may save paper and money by photocopying any or all activities as you please. Please retain our logo on all copied materials where they are displayed.

It is multi-disciplinary, can be related to various studies; it's interdisciplinary in many activities; the subject matter boundaries are broken down.

You may conduct field trips at your own school or your community.

WHAT ABOUT ???

BIG IDEAS —*The prime objectives of learning are readily expressed as generalizations or big ideas. Here are the big ideas for kindergarten and grades 1 and 2:*

Kindergarten:	Much of what we throw away is valuable or useful. Some trash may be reused (used again). What's in trash varies with the source or even the different rooms in a home.
First Grade:	Litter is solid waste out of place — on the ground, on the floor or furniture. TRASH belongs in containers for reuse, recycling or disposal. LITTER is trash not in containers.
Second Grade:	Recycling occurs naturally when leaves and other plant/animal parts decay to become part of the earth or the air. Old paper may be made into new paper by recycling.

THE STRATEGY OF INSTRUCTION

The curriculum authors were much concerned with the difficulty of learning concepts and their relation to age limitations for successful achievement of more advanced mental processes. For this reason, the number of big ideas for each grade level was held to a minimum.

The strategy for the kindergarten unit is to dramatize kinds of reuse (not recycling) from home and school trash. This also serves to demonstrate that the composition of trash varies at each source, even from room to room. See the unit folders for grades one and two for more on the strategy of instruction in those grades.

The notion of *recycling* is a complex one involving the notion of complete physical or chemical breakdown of materials with or without the use of additives. For primary age children, the idea of recycling seems to be a kind of conservation effort. The authors approached the recycling concept by considering natural recycling, composting, and the recycling of paper.

GRADE LEVEL PLACEMENT/ WHAT ACTIVITIES FOR WHAT GRADE LEVEL?

It seems best to leave the choice to you especially since, with classes of varying abilities, interests and curricular freedoms, you may even wish to utilize activities from a different grade level cluster.

INFORMATION JUST FOR YOU

WHY TEACH ABOUT SOLID WASTES?

The specter of hazardous wastes frightens every community. We are all having more and more trouble throwing things away. Each year there is actually more to put in the waste can; and each year there seems to be less space available for disposal. Surprising amounts of energy are spent or lost with our present means of getting rid of wastes. The disposal of solid wastes is the hottest environmental problem today. Hazardous wastes are the scariest problem.

Here are some reasons why you might want to share some learning experiences about trash and garbage with your kids :

Landfills are closing up; we're running out of landfill space.

Trash/garbage collection costs more and more, taking an increasingly larger tax bite.

Hazardous wastes are the focus of the latest scam by organized crime.

Everybody comes in contact with solid wastes daily.

There are excellent opportunities for drills with basic skills:

mathematics — measurement, drill and data interpretation

group leadership and interaction

language arts — spelling, writing, reports, giving oral reports to peers and adults, letter writing, vocabulary and using library and other research techniques

art — murals, posters, sketches, plays, skits, songs

values consideration — exploring the values of self and others

HOW TO USE THE CESC/CETA SOLID WASTE CURRICULUM SPECIAL FEATURES

You may be weary of seeing new curriculums and, even when you like them, wonder how you could possibly add anything more. Here's the good news about this curriculum:

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You may conduct field trips at your own school or in your community.

WHAT ABOUT ? ? ?

The Big Ideas

The prime learning objectives are prominently displayed as "The Big Ideas." If you would like your students to develop these generalizations on their own (by induction), you may block out the "Big Ideas" so that they won't appear in the photocopies.

Evaluation

One successful kind of evaluation is that in which the teachers are satisfied that objectives have been achieved. Each objective is keyed to one or more activities which should, if successfully carried out, provide evidence for the achievement of an objective. The many products of these activities, data pages, oral and written reports, drawings and murals are chief sources of evidence.

The section called "On Your Own" is not only intended to be a profitable set of follow-up activities. These activities also lend themselves as an evaluation tool.

Answers to Questions and Numerical Problems

You will find answers for all questions on pages 3 or 4 of the unit folder which is your special unit teacher's guide.

Grade Level Placement/What Activities for What Grade Level?

If the activities included in any grade level cluster present a problem, you will have to deal with it by agreement in any school or "district wide" as you choose. Certainly you will want to avoid the deadening effect of "we did this last year." You will probably want to divide the activities among or between the grades.

It seems best to leave the choice to you especially since, with classes of youngsters with varying abilities, interests and curricular freedoms, you may even wish to utilize activities from a different grade level cluster.

INFORMATION JUST FOR YOU

GETTING ENERGY FROM TRASH AND GARBAGE

This information applies to

Grades 5–6	*B–3 "Garbage to Soil". C–5 "Visiting a Recycling Center"* *D–5 "Trash Power ",E–5 "Garbage Power"*
Grades 7, 8 and 9	*D–4 "We Used Garbage For Energy"*
Grades 10–12	*"Resource Recovery" – "School Recycling Project"*

--Part of the answer to America's power shortage may be found in a dump. This practice of getting energy from trash is rapidly becoming reality. Garbage and trash, especially the organic portion, will burn. Mixed municipal solid waste is mostly composed of combustible materials, i.e. paper, plastic. More than 90% of the volume of mixed municipal solid waste can be eliminated by incineration.

--In a total resource recovery operation everything going into the waste stream, whether organic or inorganic, would become a usable "product", such as fuel, fertilizer , steam, electricity, or other salable material. Both in this country and abroad, modern pollution-controlled incinerators are using garbage and trash to produce steam. When unseparated municipal refuse is burned it heats about half as well as coal. This steam is then used either directly to provide building heat or indirectly to drive steam turbines that produce electricity. In addition to burning the organic part of refuse as a substitute for other fuels, garbage and trash can be converted into storable fuels.

--Instead of being burned, waste may also be placed in a closed chamber and baked at high temperatures in the absence of oxygen, thereby reducing the volume by about 90 percent. This form of incineration is known as "Pyrolysis" , and may bring us even closer to a state of "zero waste growth."

--Besides being a source of heat and power, organic refuse has other uses. One of these other uses is composting. Composting utilizes both bacterial and chemical processes to convert organic wastes into soil conditioners that can enrich gardens and farmlands. It is one of the oldest and most familiar forms of resource recovery. Until recently, composting has been used mainly by home gardeners.

--Municipal composting is more common in Europe where there are few land sites for waste disposal. It was hoped that a profitable business of producing compost could be started in the United States. Composting has not yet become well established in this country because there are many other sources of less expensive chemical fertilizers. The costs of separating and transporting compost to the point of use are high. However, we must also consider the benefits of composting in terms of health, cleanliness and resource conservation as well as the cost of alternative methods of disposal, before we dismiss composting as being uneconomical.

–With the demand for electric power increasing each decade, these ways to obtain heat and power from organic refuse are important additions to our energy that was required to take it away from the environment in the first place.

–To have value, materials must be recovered from refuse on a large scale basis. Before this can happen, answers must be found to the complex questions of costs, potential markets and public attitudes in order to develop a lasting solution. In the United States there is growing public concern about the problem of solid waste and a sincere desire to face the challenge.

LANDFILLING

This information applies to:

Grades 5–6	*B-1 "Open Dumps and Sanitary Landfills"*
Grades 7, 8 and 9	*B-1 "Introducing the Sanitary Landfills"*
Grades 10–12	*"Land That I Love", "The Disposal Award",* *"Leachate On The Rocks"*

Here is some pertinent information on landfills which you may find to be informative and helpful in assisting children to work on these activities.

–The landfilling of waste materials dates back to very early times. It is one of the oldest waste disposal techniques used by modern man, short of illegal or open dumping. It is still the least expensive waste disposal practice in current use.

–During the last four decades, solid waste disposal techniques in a landfill (or what used to be called a dump) have been greatly improved to minimize environmental damage, and is now termed "Sanitary Landfilling." It can be both environmentally sound and economically competitive. However, one of the important problems with landfill operations is the fact that so many are not managed efficiently or with maximum environmental safeguards.

–Sanitary landfilling is a process where refuse is spread, compacted and covered with soil in a prescribed manner to a depth of twenty-four or more inches. These techniques, when managed properly, minimize environmental degradation while trying to maximize the effective use of available land.

–When solid wastes are put into a landfill, degradation takes place as a result of various chemical and biological reactions. This degradation process produces solid, liquid and gaseous by-products. The principal gases generated are carbon dioxide and methane.

–Carbon dioxide is water soluble and can be absorbed into the ground water. Upon entering the groundwater, carbon dioxide lowers the pH (or increases the acidity level), thereby magnifying its corrosiveness.

–Methane is relatively insoluble in water and, because of it s lightness or low density, it will migrate

vertically or laterally through the refuse into the atmosphere or surrounding areas. Methane gas is both explosive and toxic. It is toxic in the sense that anyone entering a room or chamber filled with methane would suffocate from a lack of oxygen.

--As rain water or ground water percolates through a landfill, it becomes contaminated with water soluble products from the solid wastes or their decomposition. This escaping water with its additional dissolved or suspended matter is called leachate. It can migrate from a landfill and directly affect the quality of ground and/or surface water nearby.

--To maximize environmental protection, hydrological and geological investigations are necessary before the site of a sanitary landfill is chosen. These investigations will determine whether the earth at the site is compact enough to prevent the leachate from entering the ground water. A surface and ground water quality monitoring program in conjunction with an impervious substrate or foundation are management techniques and site qualities which a desirable potential landfill site should have. The following methods should also be utilized to maximize environmental protection:

A. Leachate collection and testing
B. Capping with twenty-four inches of soil
C. Methane gas control
D. Monitoring the drainage basins where leachate collects.

--The failure to adhere to these protective measures leads to the dangerous states of contamination which have recently been so alarming to the general public.

SOURCE SEPARATION AND RECYCLING

This information applies to:

Grades 3–4	*B–2 "Recycling Relay Game"*
Grades 5–6	*Unit C (all activities)*
Grades 7, 8 and 9	*D–2 "What If We Source Separate?"* *D–3 "What If We Recycle Steel, Aluminum and Glass?"*
Grades 10–12	*"Source Separation", "Getting Involved".*

The volume of municipal solid waste generated in New Jersey each day is of sufficient volume to fill Giants Stadium every two weeks.

As solid waste management problems have become increasingly evident, methods have been sought to mitigate the negative aspects of "garbage." Planners have sought to develop measures that would both lower the volumes of materials going to landfills, as well as put that particular material to a subsequent use. Recycling of material such as newspapers, glass and metals performs both of these functions.

Under New Jersey Public Law 1975, Chapter 326, entitled the New Jersey Solid Waste Management Act, each county and the Hackensack Meadowlands Development Commission were designated as solid waste management districts. Under the Act, each district is responsible for developing and implementing plans which provide for the "maximum practicable use of resource recovery strategies" (i.e., recycling).

Source separation programs are a major component of the overall resource recovery strategy now being utilized in many communities. A source separation plan sets forth a comprehensive program whereby a private contractor or municipal collectors will provide curbside collection of recyclable materials, such as paper, glass and metals. If private contractors are used, they are not paid by participating communities for this service. Instead, they are expected to offset their capital and operating costs and receive a reasonable rate of return on their investment through revenues generated from the sale of recyclables. A less comprehensive plan depends upon curbside collection by private service groups or by voluntary citizen drop-offs at a municipally maintained collection point.

Scout troops, charitable organizations and other accepted individual scavengers will be able to continue their operations with only minor changes in their present collection methods. In fact, recent studies indicate that such groups thrive when coexisting with a formalized municipal program.

Consider the advantages to a municipality of community sponsored newspaper recycling alone:

1. Rebates from the newspaper collector based on tonnage of newspaper recovered.
2. Rebates from the mixed-refuse collection in townships with contracted garbage collection systems or, in the case of townships with their own regular garbage collection systems, direct cost savings are encountered through the decreased volume of waste physically collected by them.
3. Rebates from savings encountered by re-routing regular garbage collection vehicles in a more energy efficient manner by taking advantage of less regular waste found at each collection stop.
4. Reduced disposal costs due to less material to be landfilled.
5. Conservation of scarce and costly landfill capacity.

With each ton of newspaper recycled, three cubic yards of landfill space is conserved and seventeen trees from our valuable forest lands need not be cut down for their pulp value. In addition, 60% to 70% less energy is utilized in producing new pulp products from recycled paper, versus virgin wood pulp.

Oil is not the only imported material which is having an impact on the United States trade deficit and contributing to the current inflationary spiral. Numerous raw materials used in manufacturing processes are imported into the U.S. Many of these raw materials are presently in the municipal waste stream and could be recycled to produce an economically attractive domestic supply. New newsprint is only one example. Implementation of a vigorous and comprehensive newspaper recycling program will help alleviate the U.S. dependence on imported newsprint. At the same time, this effort will also foster the strength and expansion of recycling industries which contribute significant primary manufacturing strength to the New Jersey economy through jobs and ratables. The proposed recycling programs should afford the resident an opportunity to effectuate a change in historically wasteful and environmentally damaging solid waste management trends.

The New Jersey Recycling Act of 1981 (P.L. 1981, Ch. 278) provides significant incentives for municipal recycling efforts. As of January 1, 1982 all municipalities in New Jersey have been paying a surcharge on all wastes dumped in any landfill located in the state. The surcharge of 42 ¢ per ton creates a Recycling Fund. Each community which can demonstrate the existence of an on-going recycling program may apply for a rebate for funds to purchase new recycling equipment or for public education. Also available are competitive education and planning grants and low interest loans to recycling industries.

HAZARDOUS WASTES

This information applies to:

Grades 7, 8 and 9	*C–1 "Hazardous Waste Is....."* *C–3 "Hazardous Wastes: Harmful or Healthy?"*
Grades 10–12	*"Land That I Love", "The Disposal Award"*

Hazardous wastes are discarded materials that pose a substantial threat to human health or the environment when improperly handled for disposal.

Every year billions of tons of solid wastes are discarded in the United States. These wastes can come from common household trash, industrial wastes, sewage sludge, agricultural residues, mining refuse, military operations and pathological wastes from institutions such as hospitals and laboratories.

Hazardous wastes generally come from discarded industrial products and are often in the class of substances popularly referred to as chemicals. Spent materials from nuclear reactors are also very hazardous when discarded.

These wastes can be in the form of solids, liquids, sludges or gases in pressurized containers. They differ from other solid wastes in that they have one or more of the following characteristics: ignitable, reactive, toxic, corrosive, infectious or radioactive.

The U.S. Environmental Protection Agency (E.P.A.) estimates that in 1980 at least 57 million metric tons of the nation's total waste load can be classified as being hazardous. Some hazardous wastes are eventually neutralized chemically by decomposition or oxidation in the soil and air at their disposal sites. Others may not break down and thus remain dangerous indefinitely. Unfortunately, many dangerous wastes that society has thrown away over the recent decades have remained unchanged and are now leaking from corroded containers. They often leak into the earth and ground water from which fresh water supplies are pumped.

Hazardous wastes may cause or significantly contribute to serious illness or death. They can poison, burn, maim, blind and kill living organisms. They can affect the human nervous system, internal organs and skin disorders, cancer and birth defects. Sometimes their effects can be felt immediately after exposure; at other times they may not show up for weeks, months or years. Many do not break down in the environment.

The U.S. Surgeon General has described the problem of hazardous waste disposal as a "major public health concern" that will plague the nation for years. Although more stringent disposal rules have been adoped, the improper handling and disposal of hazardous wastes has continued unabated. Tighter rules may have led to recent increases in illegal disposing.

Because of the intense publicity and shocking effects of hazardous wastes on human health and because more and more hazardous wastes were being located in 1980, a great public outcry was raised. Victims or those who perceived themselves as threatened, vigorously demanded aid and financial reparations from chemical industries and the state and federal governments.

In December 1980 President Carter signed a "Superfund Bill" into law requiring the chemical industry to contribute toward the clean-up of chemical spills and abandoned waste disposal sites. This was a scaled-down version of the original bill which had been the subject of frantic compromising during the closing hours of the 96th Congress.

The revenue which the bill generates covers a special tax to be levied by the chemical industry with the larger remainder to be taken from general taxes. The bill offers no reimbursement for individual citizens affected by toxic wastes; it offers no coverage for oil spill damage. However, it represents a first step toward relieving the growing hazard of toxic chemicals seeping into the nation's land and waters. Many industries are now lobbying to place more of the clean-up cost burden on the public, both through federal subsidies and direct sales charges.

SOLID WASTE/ENERGY CURRICULUM

GRADE K

THE TRASH TREE

The Trash Tree is a group of four units. Each unit is accompanied by several activity sheets. The units are:

1. The Classroom Trash Tree
2. The Home Trash Tree
3. The Let's Use It Again Tree
4. What Do I Feel ?

These units are intended to be presented sequentially but may also be used separately at the discretion of the teacher.

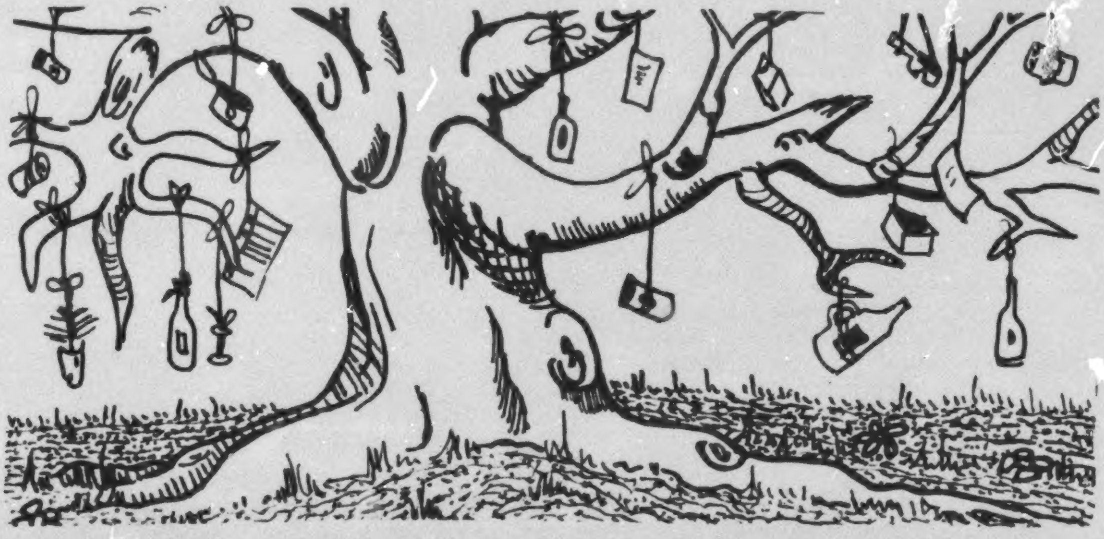
1. THE CLASSROOM TRASH TREE

The Preparation:

1. Select an open bulletin board in your classroom and cover it with white construction paper, or you may wish to use a dead tree, an artificial Christmas tree or a large branch. Support it with a cinder block or Christmas stand. Do not cut live material.
2. If you are using the bulletin board, draw a large tree with 6-8 branches on the construction paper. Have thumb tacks and string available.
3. Have four waste baskets available containing clean trash usually generated in the class.
4. Place some additional articles in each trashcan that are not trash, (toys, clothes, or other articles currently in use).

The Action:

1. Explain to the students that they are going to put "leaves" on the tree by using articles of trash found in the trashcans.
2. Each student should be given a chance to pick an article of trash out of the trashcan.



3. If the article chosen is a trash item found in the classroom, tie some string around the item and tack the string and item to the tree.

4. If the article chosen by the student is still usable or not a piece of trash found in the classroom, do not tack it to the tree. Have a group discussion on why these items are not being tacked to the tree.

5. If some items are too heavy, place them under the tree on a table or on the floor.

6. In the discussion about the Classroom Trash Tree, you will have an opportunity to bring out differences between trash and non-trash, and the variety of trash items produced in the classroom.

7. Following the discussion you may utilize the worksheets as desired.

Children's Worksheets For The Trash Tree Unit I

What Is Trash?
Have the children complete the 'T' on the sketches that show trash. *K-I-1.*

What Isn't Trash?
Have the children complete the 'X' on the sketches that do not show trash. *K-I-2.*

Color The Trash.
Have the children color the sketches that show trash. *K-I-3.*

What Is Classroom Trash?
Have the children complete the 'S' on the sketches that show trash found in your schoolroom (classroom). *K-I-4.*

Distinguishing Non-schoolroom Trash.
Have the children complete the 'X' on the sketches that do not show trash found in the classroom (schoolroom). *K-I-5.*

What's A Trash Container?
Have the children complete the 'C' on the sketches that show a trash container. *K-I-6.*

What's Not A Trash Container?
Have the children complete the 'X' on the sketches that do not show a trash container. *K-I-7.*

II. THE HOME TRASH TREE

The Preparation:

You will need to enlist the cooperation of the children's parents for this show-and-tell unit. A note sent home with the student requesting the parents to allow the student to bring one non-dangerous, clean item of trash from home is desired. Instruct the children to:

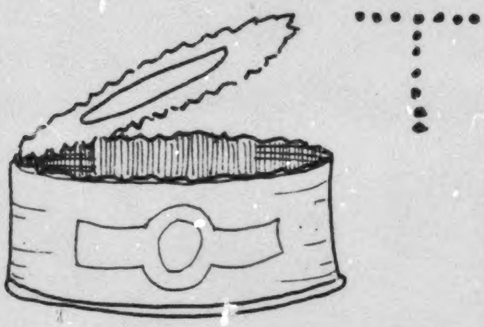
1. Take the note home to their parents.
2. With their parents, choose a piece of trash to bring to school.
3. Remember in what room of the house they found the item of trash which they selected to bring in.
4. Determine why they found their home trash item in that particular room. Once the students trash items are in class, you are ready to construct the home trash tree.
5. You may draw a new tree or add items to the school trash tree. You may mark the home items with a bit of twine or some other acceptable identifier.

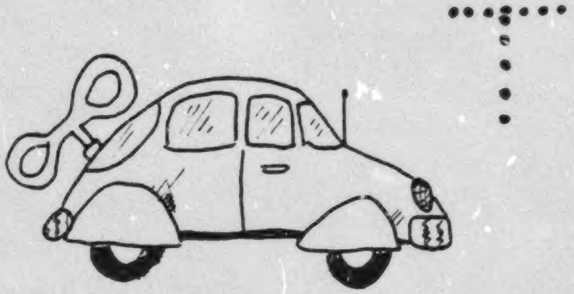
The Action:

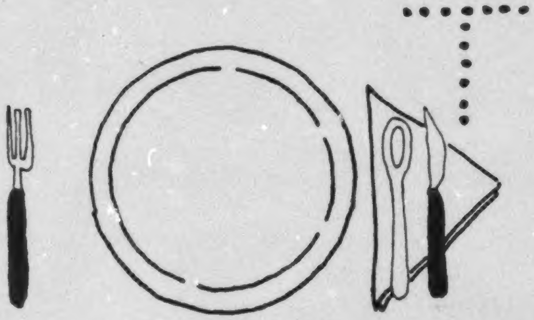
1. Have each child come to the front of the class and tell about his/her piece of trash.
   a. Where did it come from?
   b. What was it used for?
   c. What room in the house was it found in?
2. Fasten the item to your trash tree.

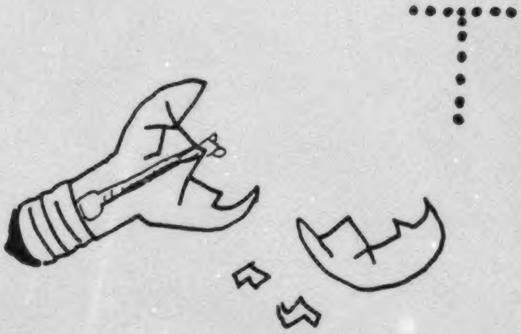
WHAT IS TRASH? K - I - 1

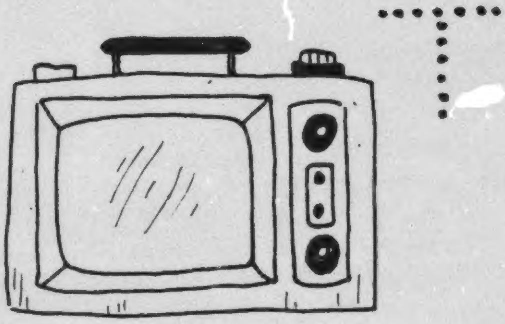
Complete the 'T' on the sketches that show trash.

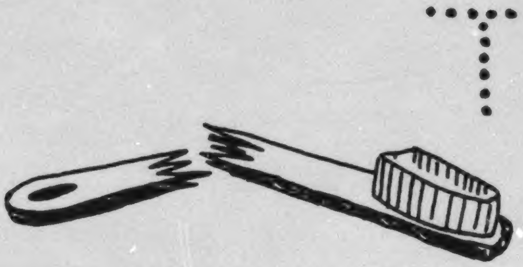


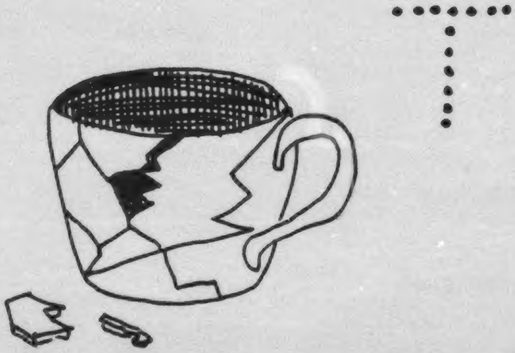


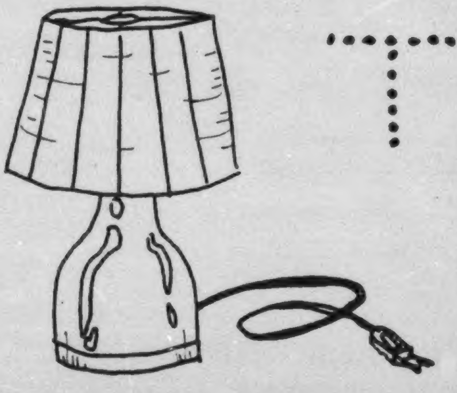








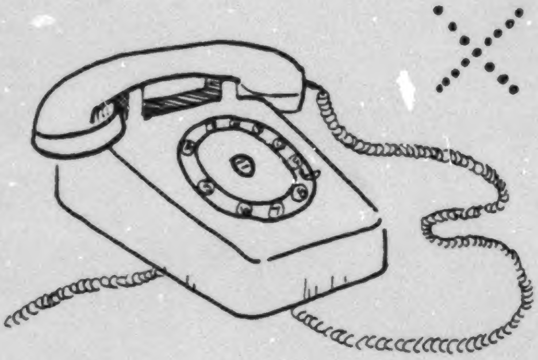


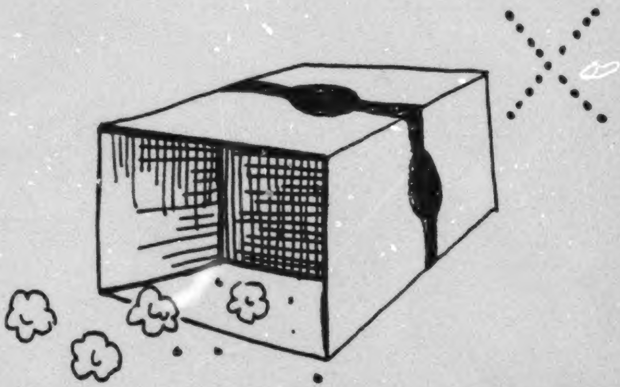


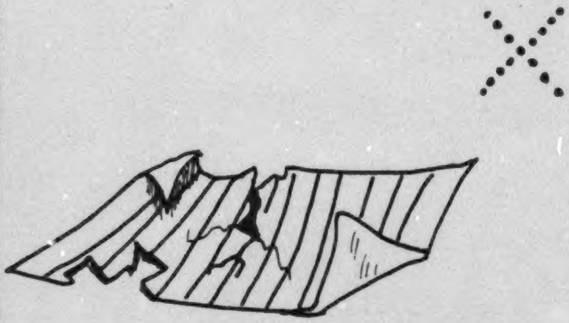
WHAT IS NOT TRASH?

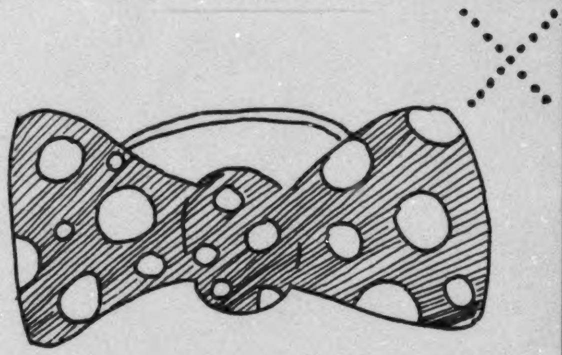
K - I - 2

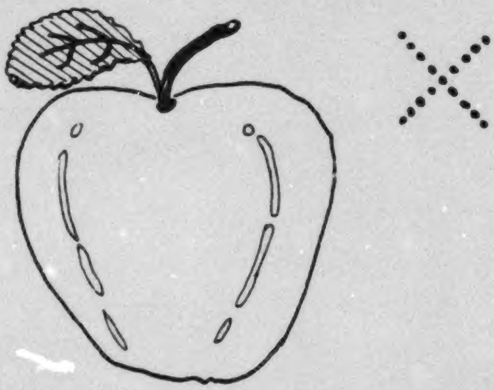
Complete the 'X' on the sketches that do not show trash.

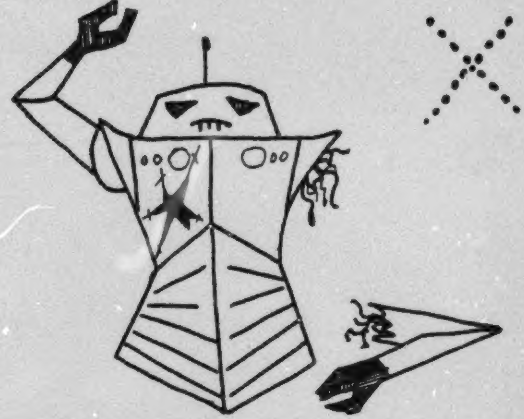


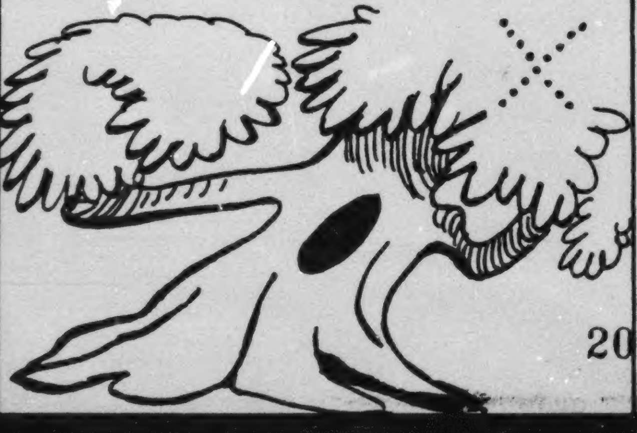


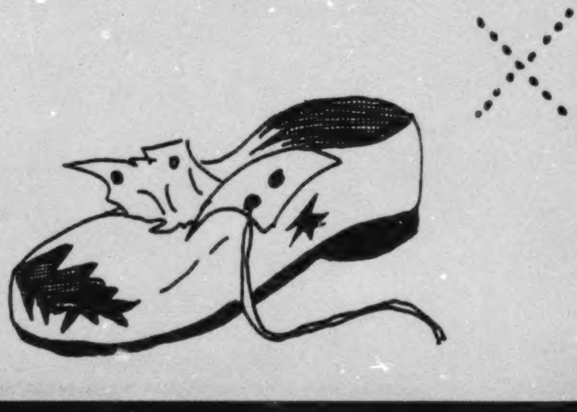








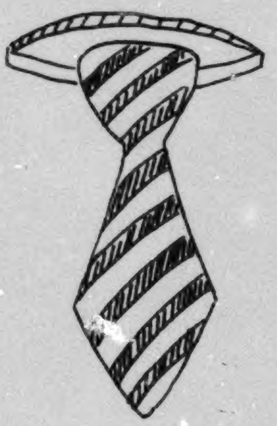


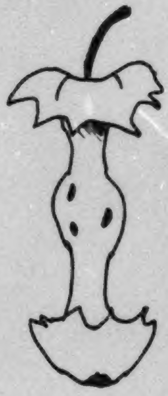


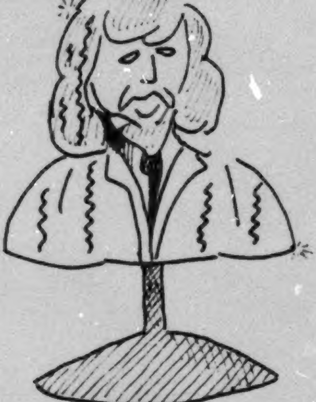
COLOR THE TRASH.

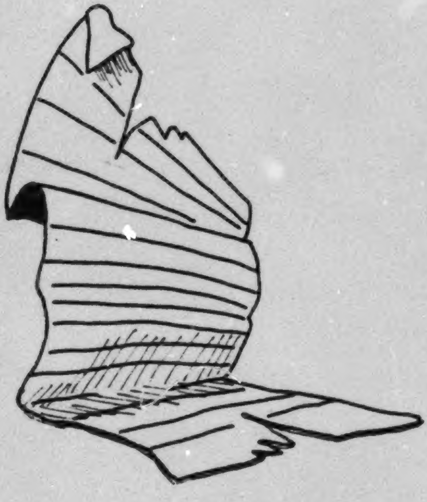
K - I - 3

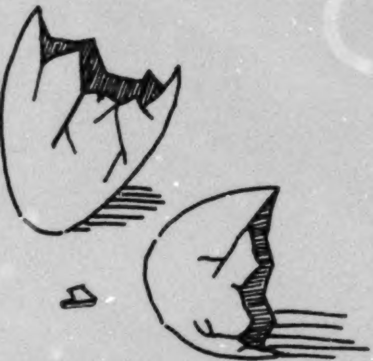
Color the sketches that show trash.

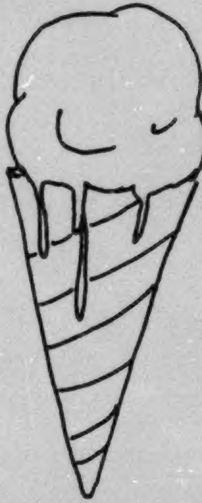


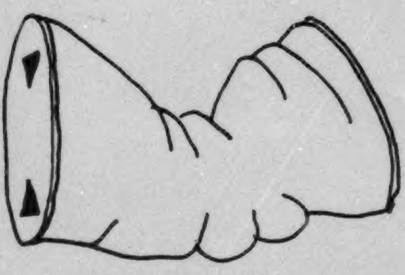


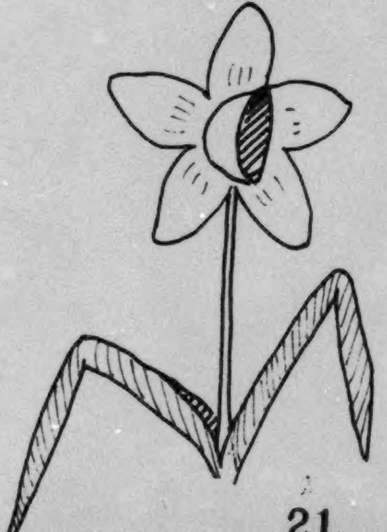


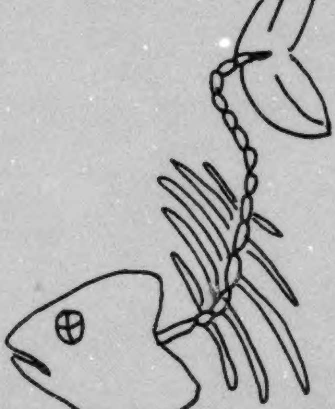








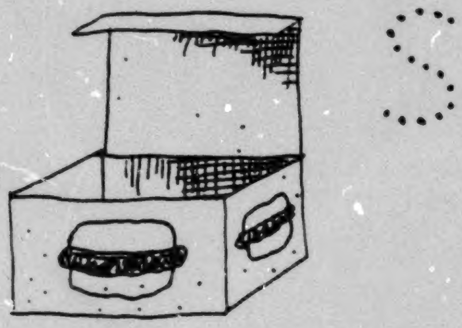


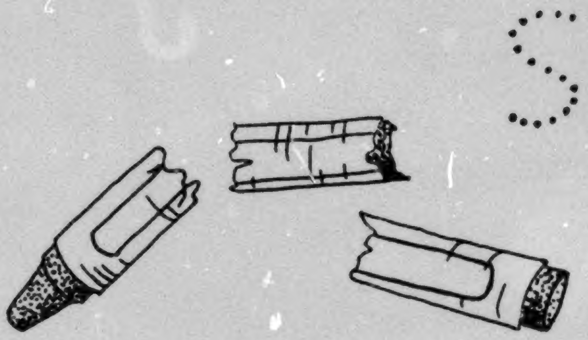


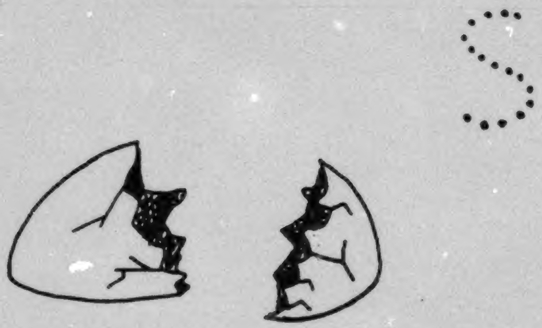
WHAT IS SCHOOLROOM TRASH?

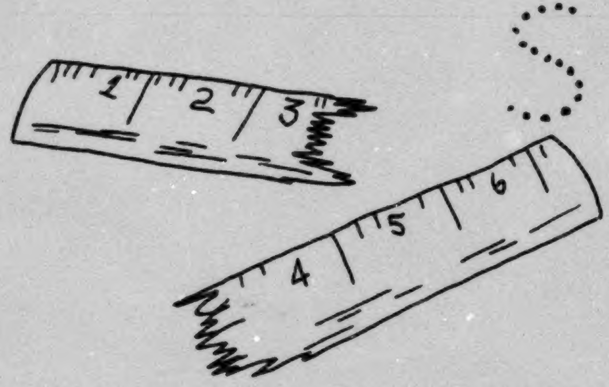
K - I - 4

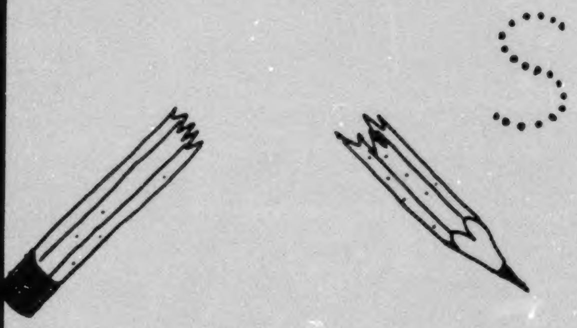
Complete the 'S' on the sketches that show trash found in the schoolroom.

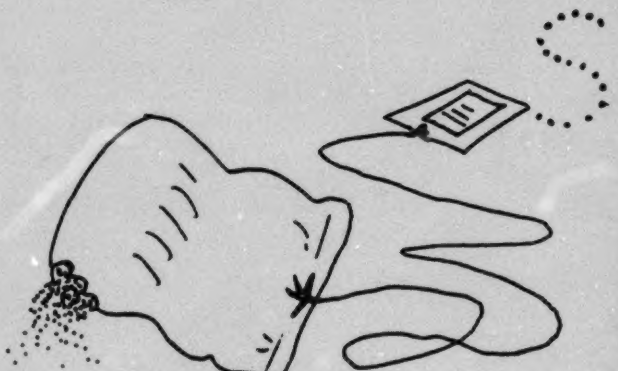


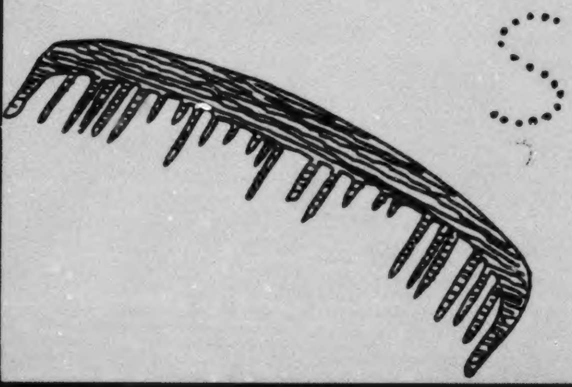


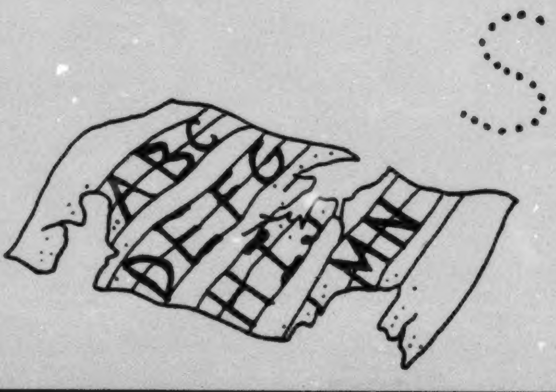






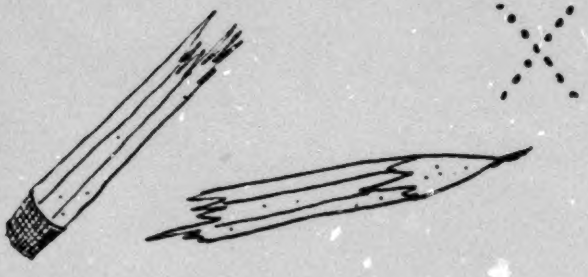


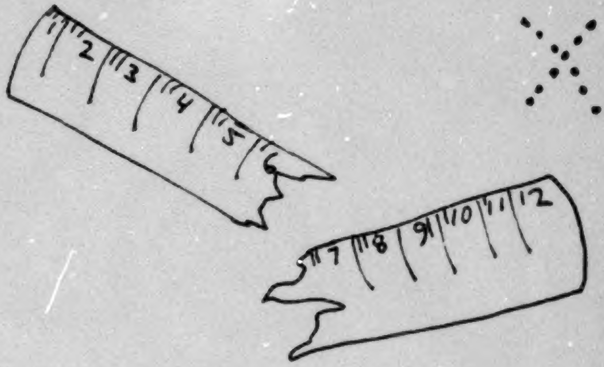



ABC
DEFG
HIJ
MN

WHAT IS NOT SCHOOLROOM TRASH? K - I - 5

Complete the 'X' on the sketches that do not show trash found in the schoolroom.

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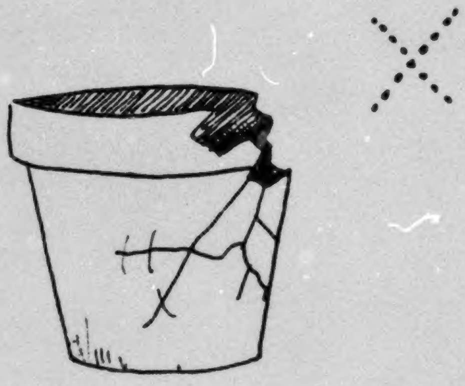
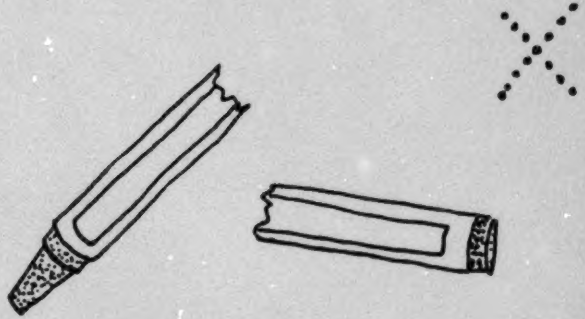
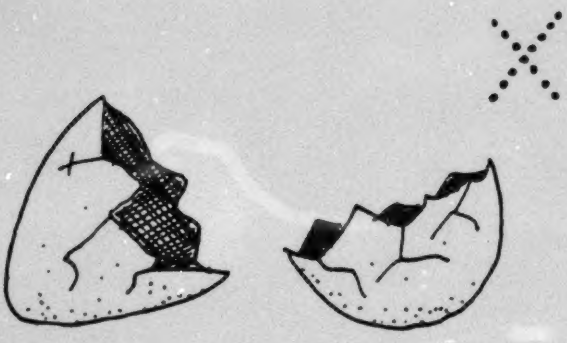
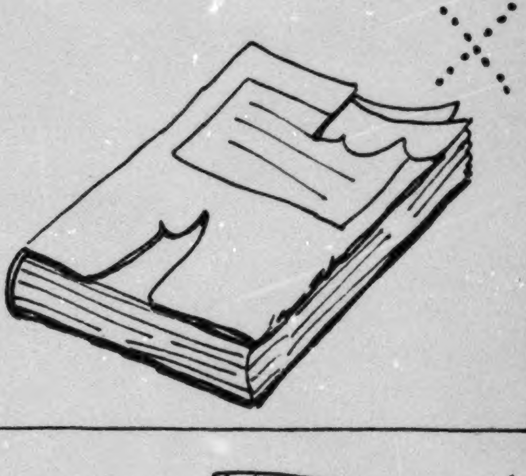
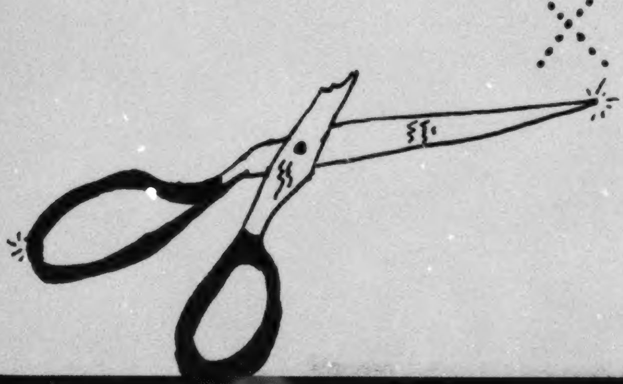
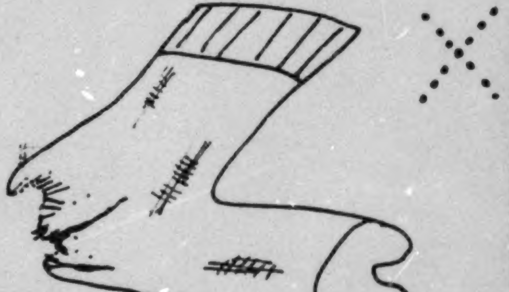






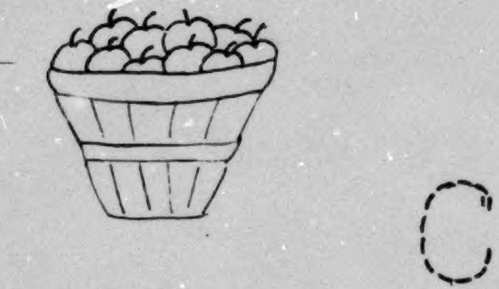


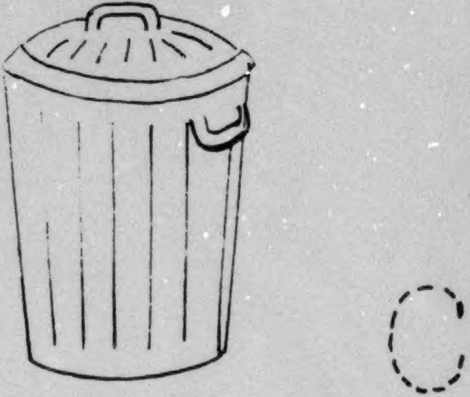


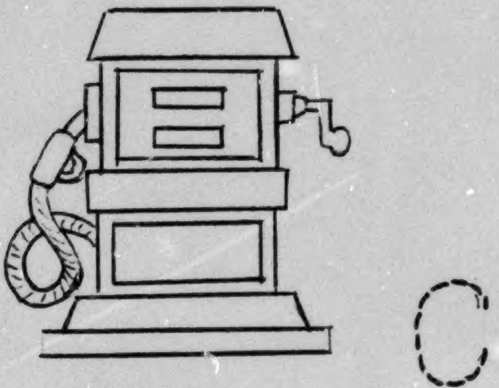


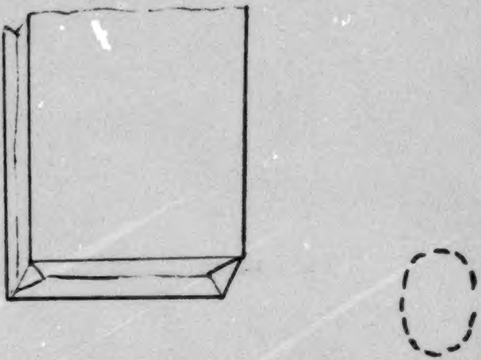
WHAT IS A TRASH CONTAINER?

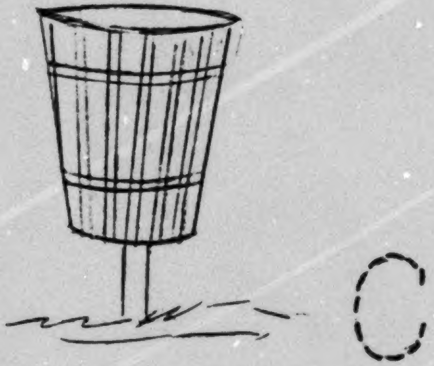
Complete the 'C' on the sketches that show a trash container.

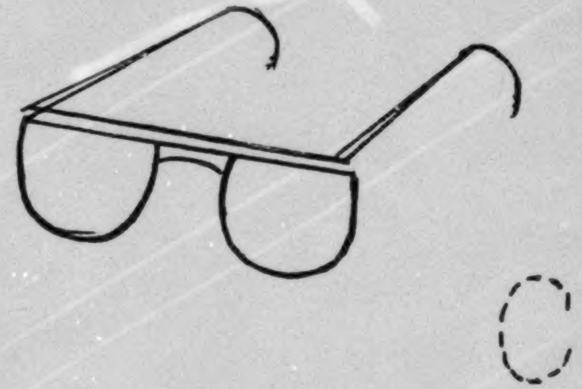


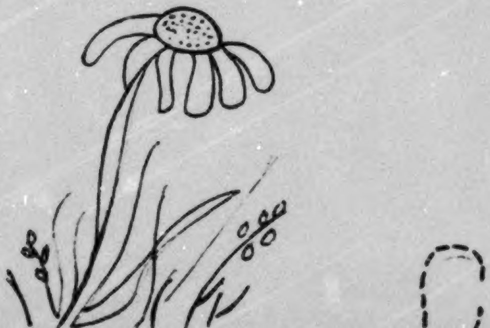


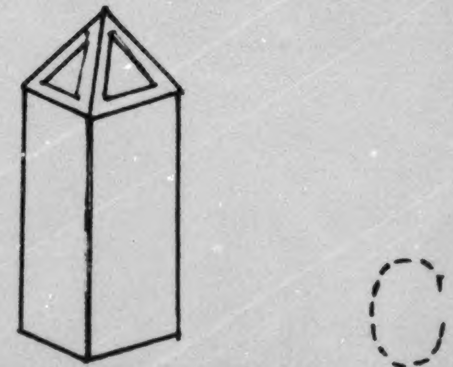








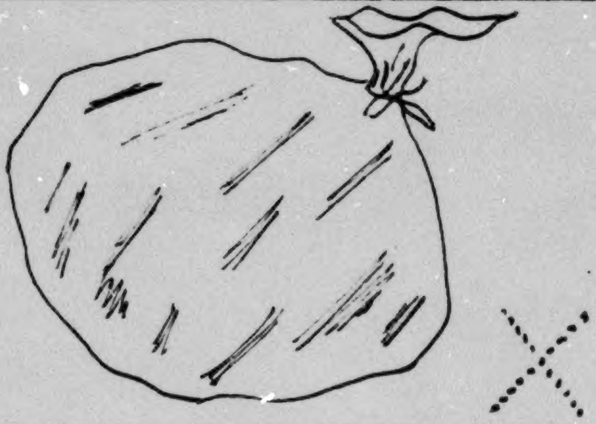


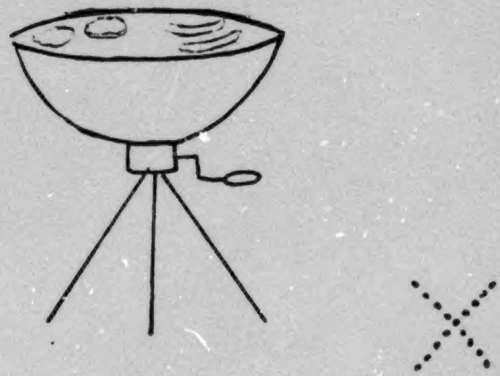


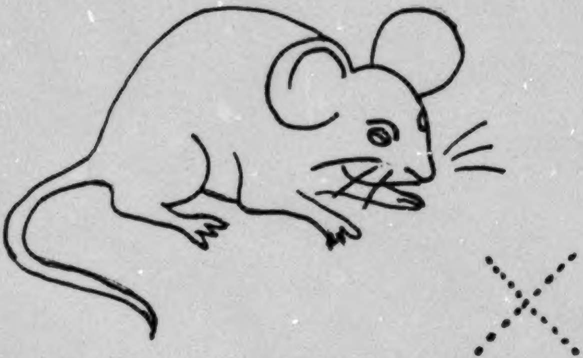
WHAT IS NOT A TRASH CONTAINER?

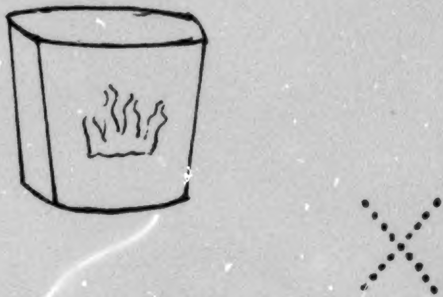
K - I - 7

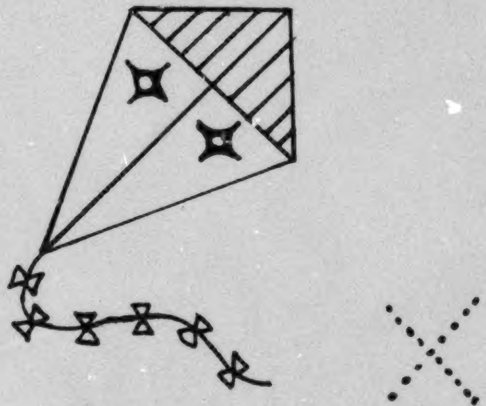
Complete the 'X' on the sketches that do not show a trash container.

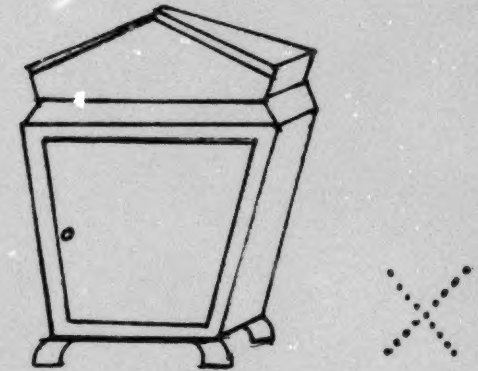


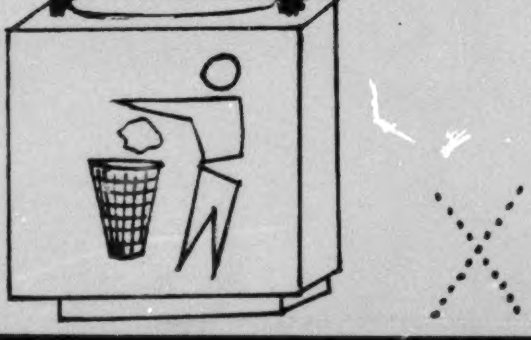


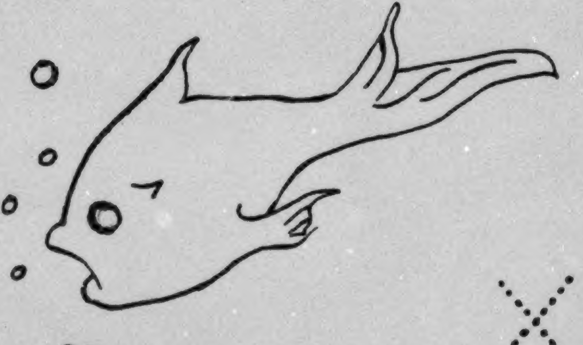






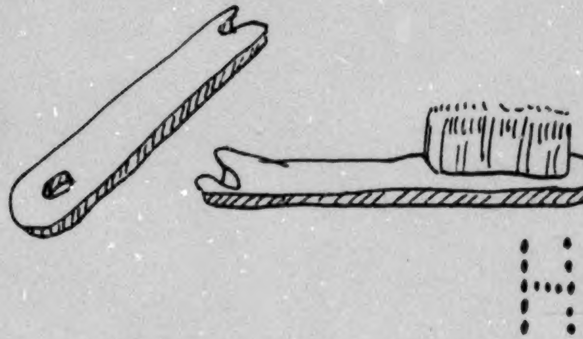


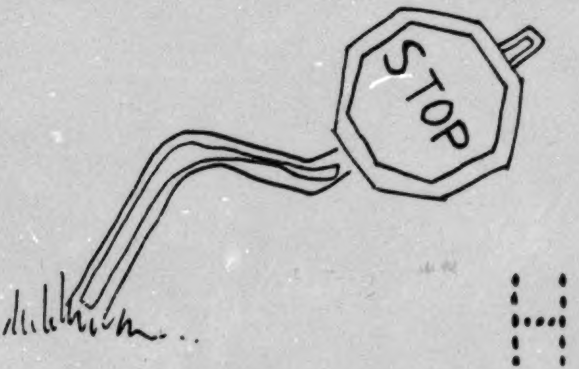


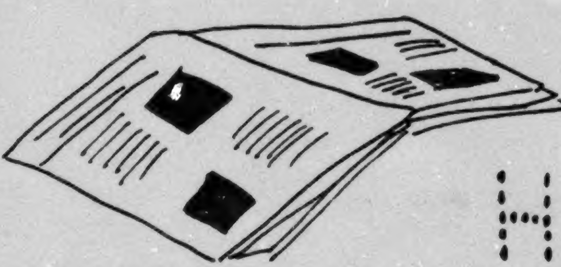


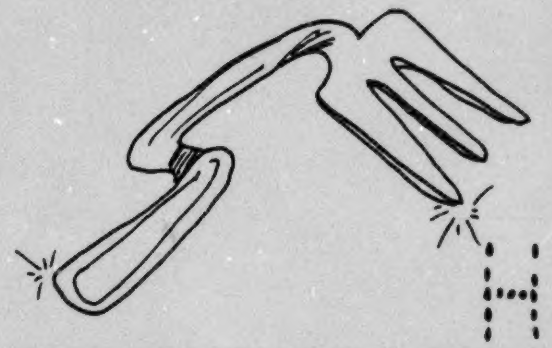
WHAT IS HOME TRASH?

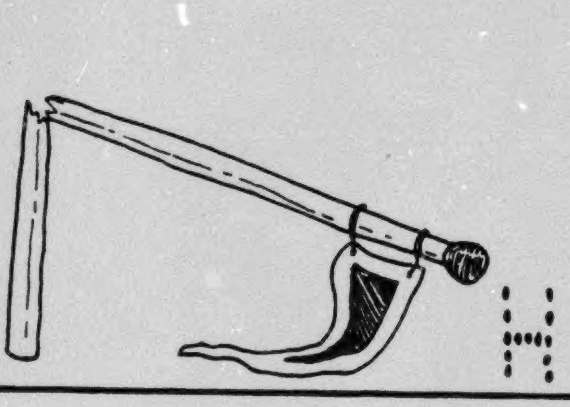
Complete the 'H' on the sketches that show trash found at home.

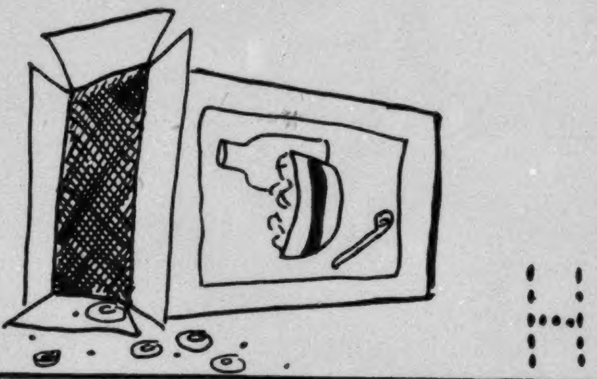


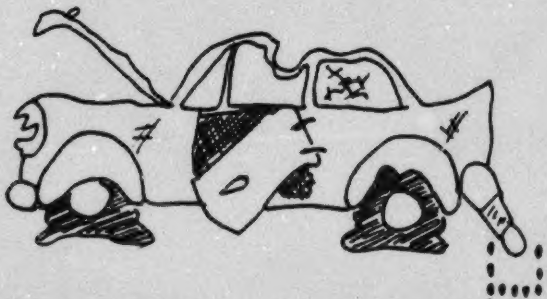


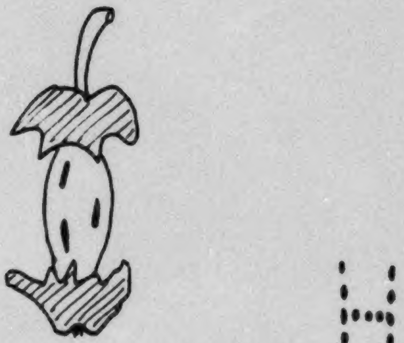








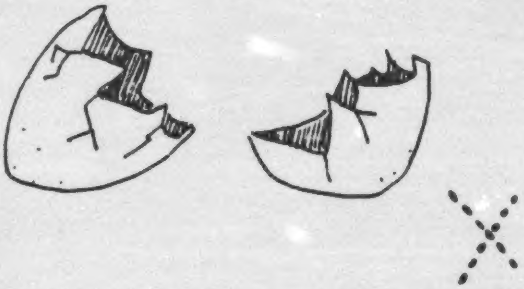


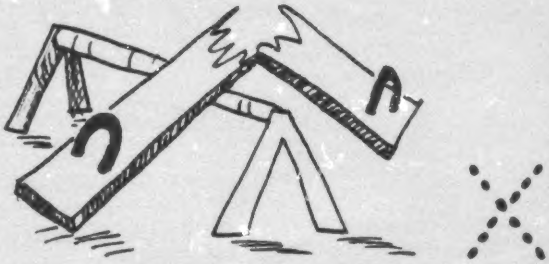


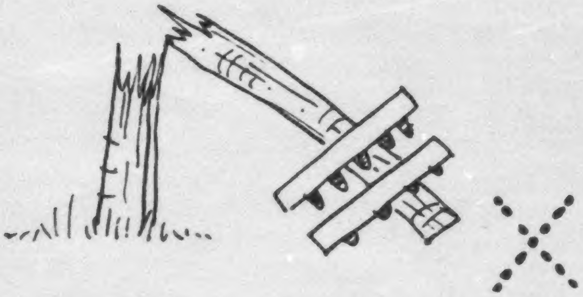
WHAT IS NOT HOME TRASH?

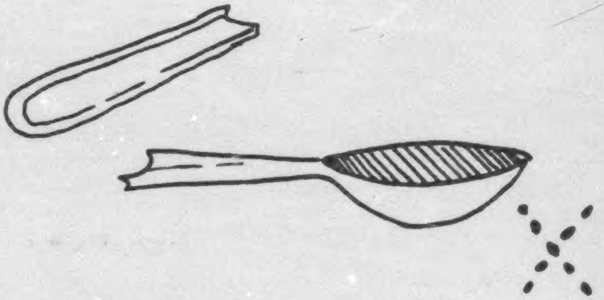
K - II - 2

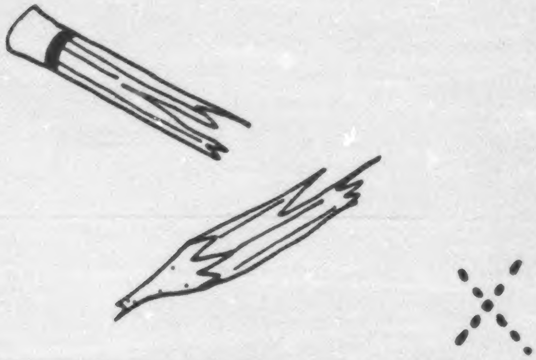
Complete the 'X' on the sketches that do not show trash found at home.

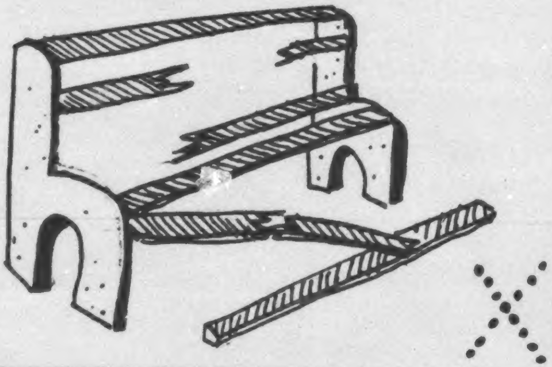


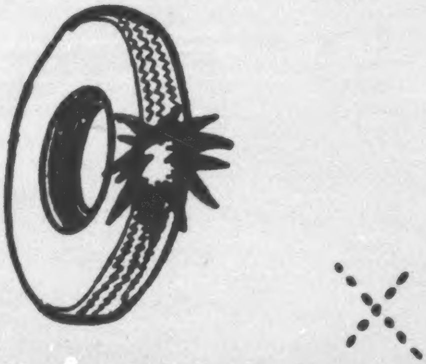


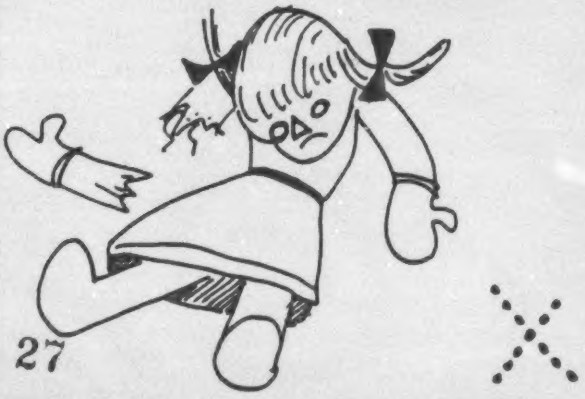






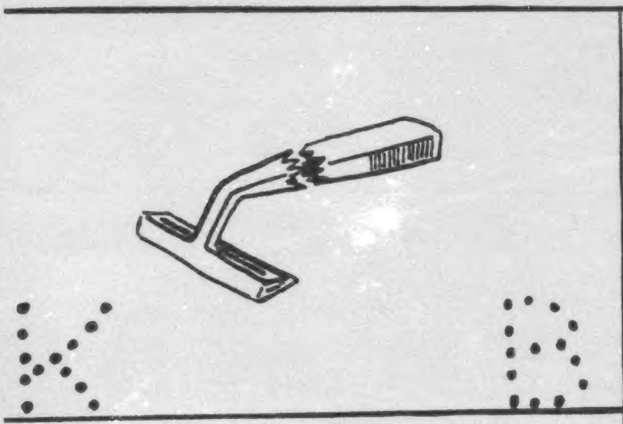


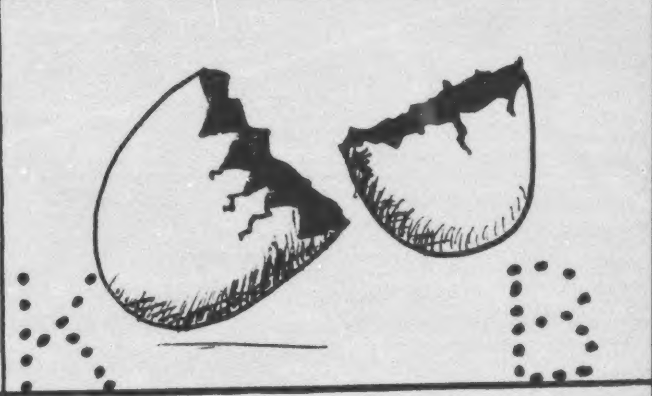


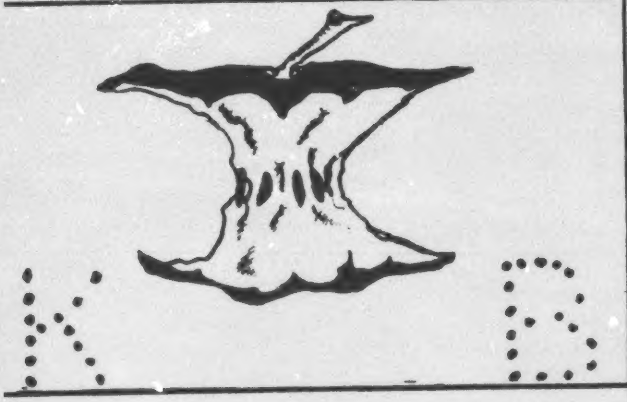


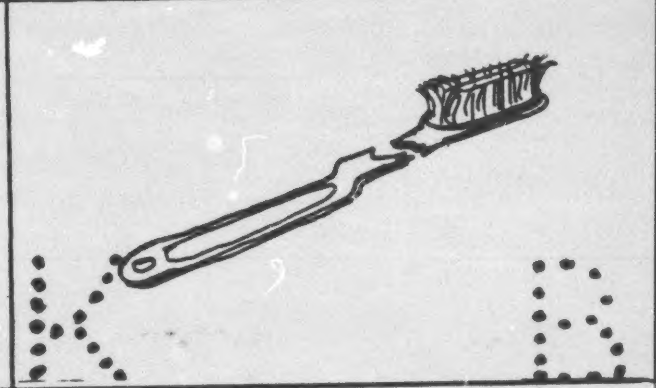
KITCHEN OR BATHROOM TRASH?

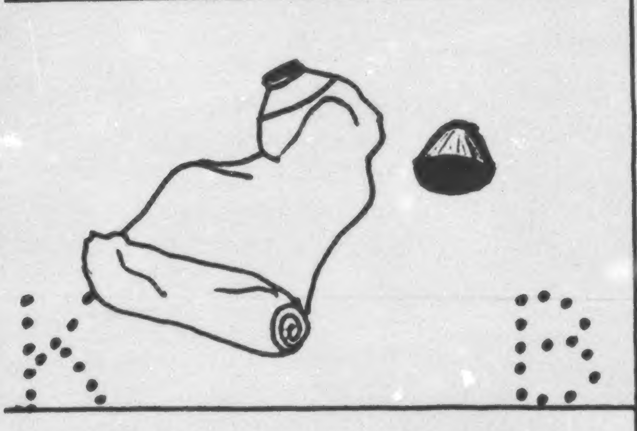
Complete either the letter 'K' for kitchen or 'B' for bathroom on each sketch depending on what room the trash is is found.

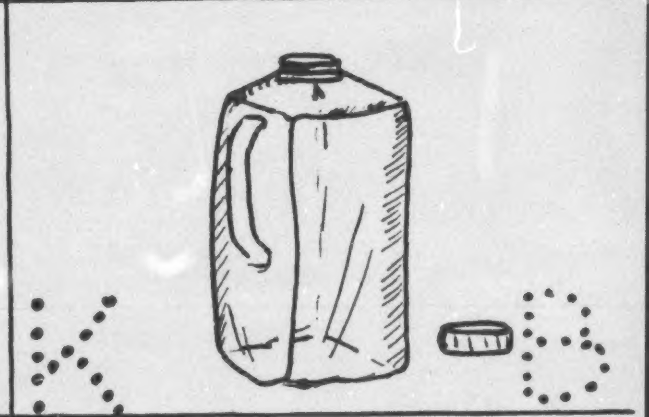


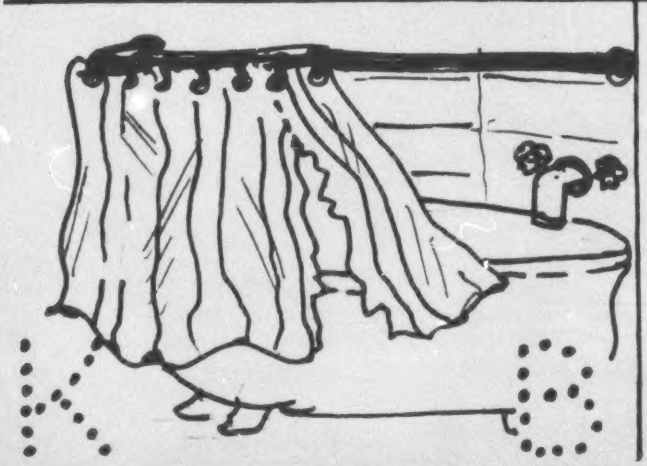


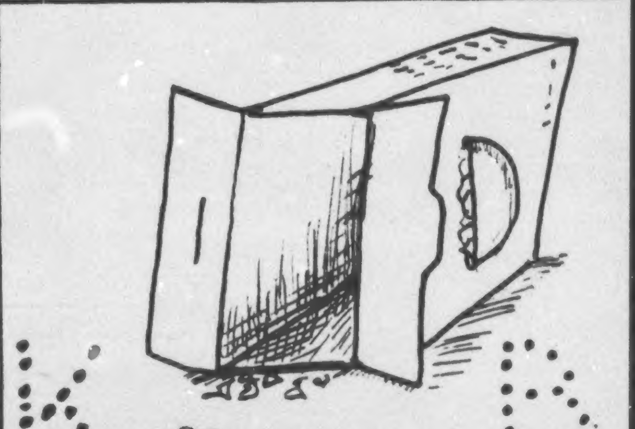






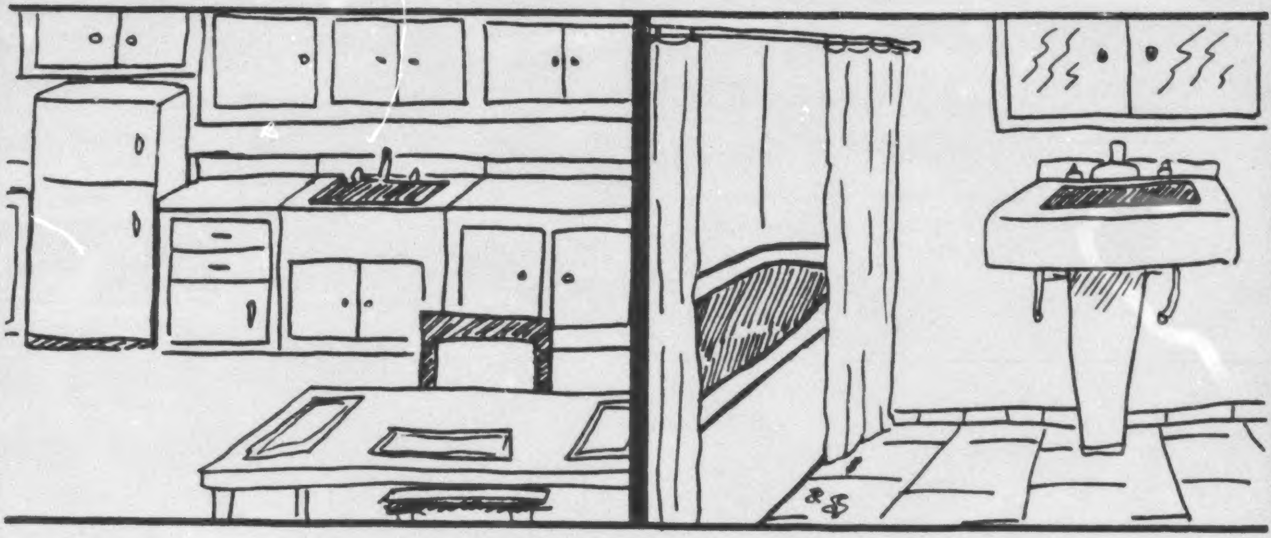


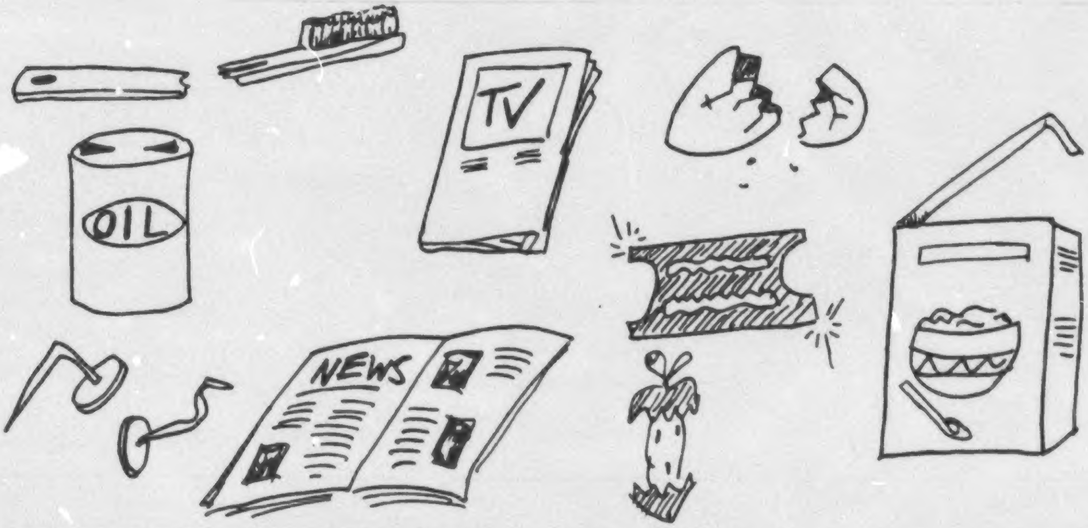


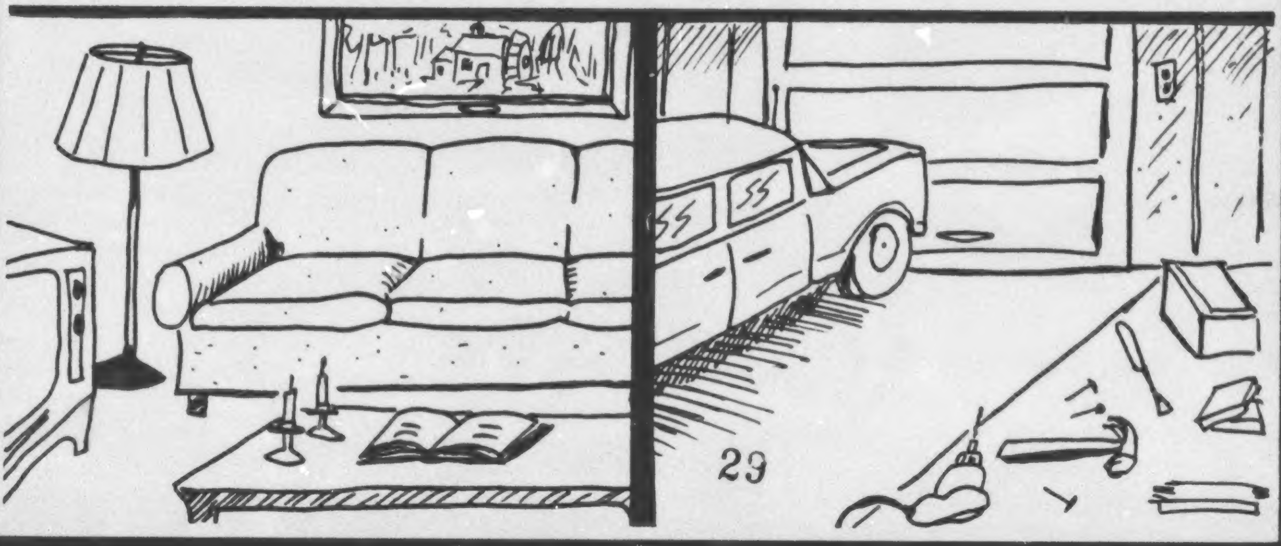


WHICH TRASH IN WHICH ROOMS?

Draw an arrow from each sketch of trash to the room in which that trash would be found.

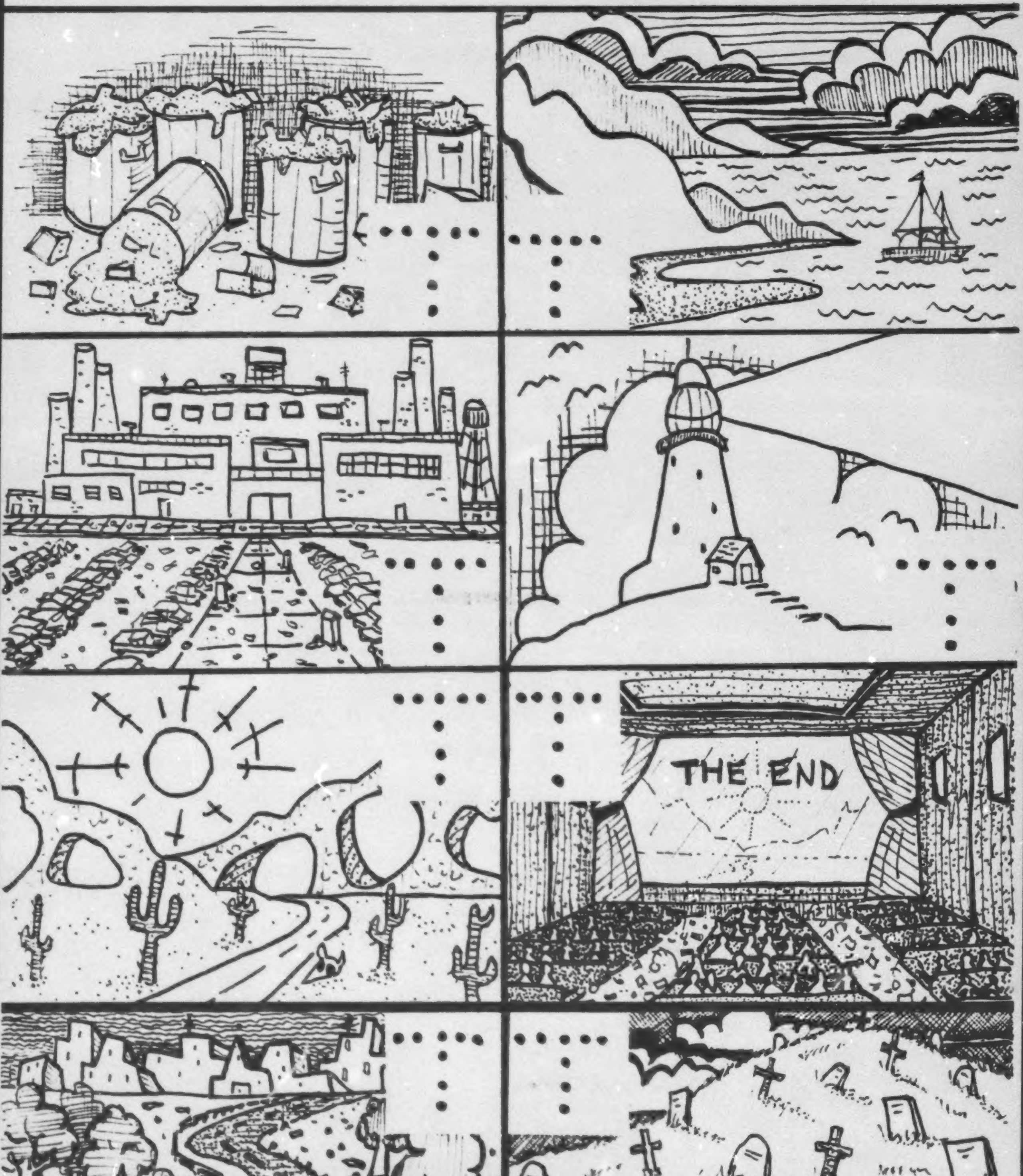






WHERE DO WE FIND TRASH?

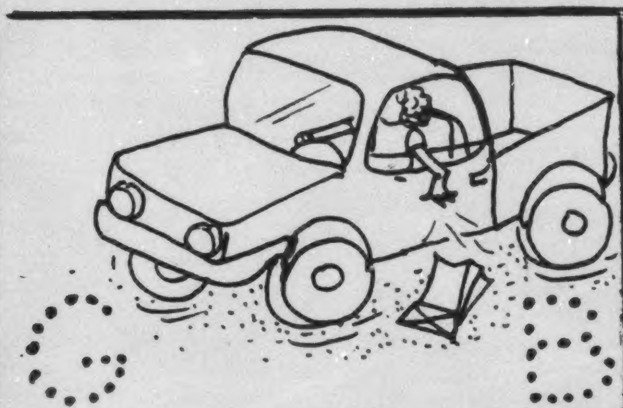
Complete the 'T' on the sketches where you find trash.

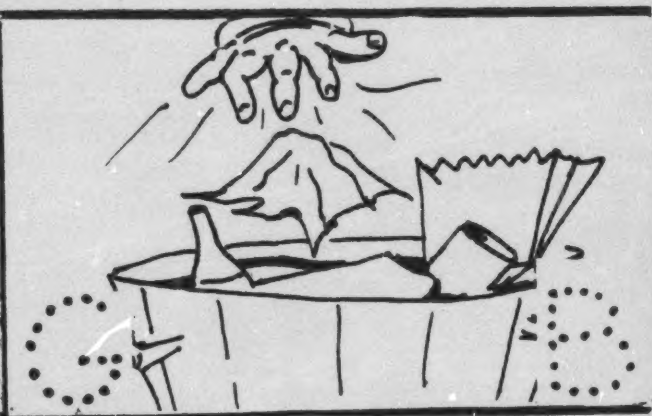


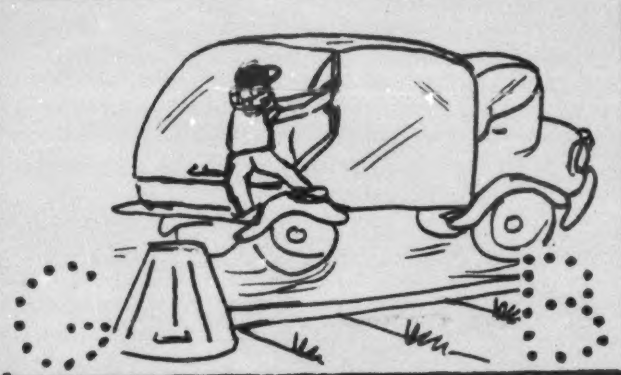
GOOD OR BAD?

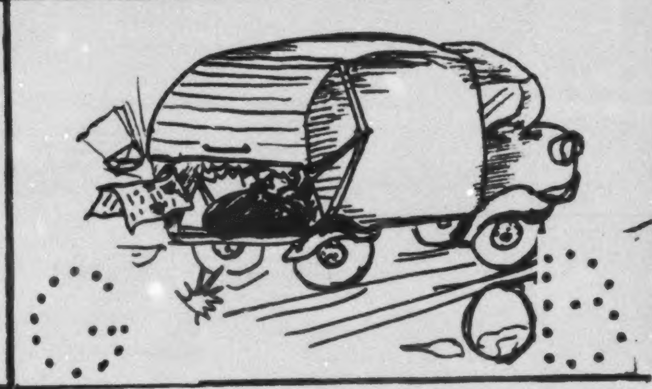
K - II - 6

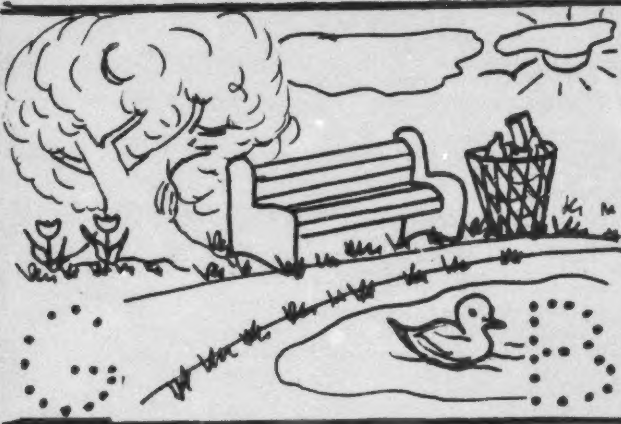
Complete the letter 'G' for good or 'B' for bad on each sketch depending on whether or not you feel the trash is being taken care of properly.

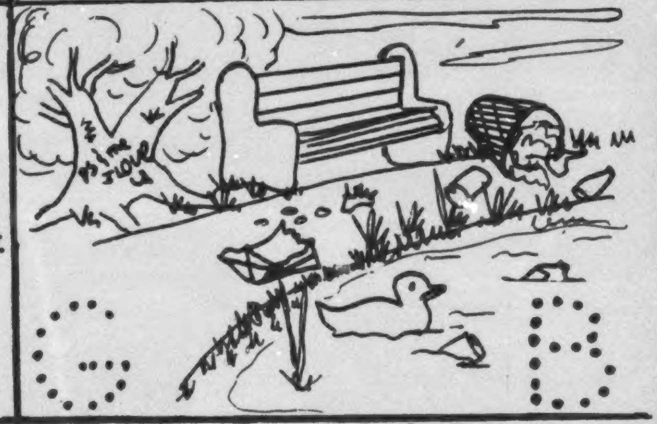


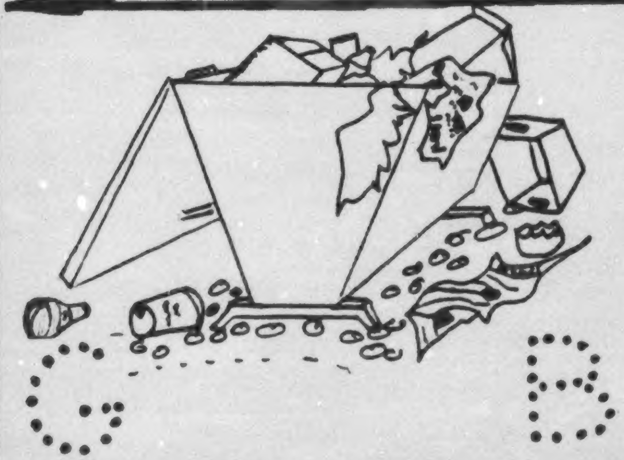


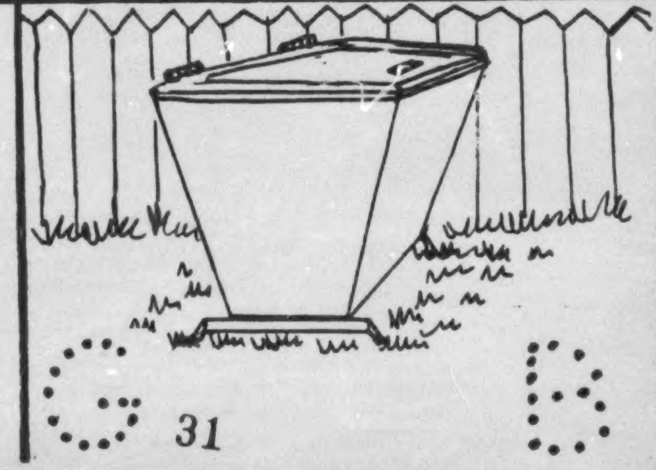












(Supplement to be used with Kindergarten Unit *3 The Reuse Tree.*)

Please read the following short story to your class after you have initiated a discussion about "reuse." This short story may help the children understand the idea and necessity of "reuse."

As you read the story, have the children assist you in pointing out everytime something is being "reused."

THE PEOPLE OF "HAVE-NONE" ISLAND

This is a story about the people who live on the island of Have None. This island is in the middle of the most dangerous ocean in the world. So hard is it to cross, few countries would dare ship supplies to Have None.

"How could they possibly live without getting things to eat or use", I thought. The rest of the people of the world felt very sorry for the people of Have None. They wanted to help but were afraid to cross the ocean. They thought the people of Have None must surely be very sad and poor. I decided to find out for myself.

My ship landed on the shores of Have None after fighting the dangerous ocean for almost a year. I was surprised to see a beautiful village standing before me. The people of the village gathered around as we climbed down from the ship. The people welcomed my crew and me with open arms.

While talking to the people of the village, many of the questions I had wanted to ask were soon answered. The Chief told me that a supply ship comes to the island, but only once every five years. The supplies from the ship never last very long, so the villagers use almost everything they have over and over again.

I was told that they never throw away a piece of clothing. The Chief explained to me that when something begins to rip and becomes worn, they simply put a patch on it. When something becomes too old and can't be patched anymore, they use it to make other patches or dishcloths. I found out that most of the clothes worn by the children of Have None Island are passed down from an older brother or sister. These things were given to them by an even older brother or sister.

I was told that the people build their own homes and furniture. There aren't many trees on the island so the villagers have to keep using what wood they have time and time again. First, pieces of new wood are used to build a house. Only when a house is too old and unsafe to live in, will the villagers be able to make other things they need from the wood in the old house. The people take the house apart very carefully, they then use the wood to make chairs, tables, beds, picnic benches and toys for the children. When they build the furniture, they use the same nails they used to build the house.

The villagers explained to me that they always keep their empty bottles and jars. They have many uses for the bottles and jars. They use the jars to store food and the bottles to store water. They also use them as drinking glasses or bowls to eat out of, if the bottles or jars are the right shape.

While walking along the streets of the village I noticed that all the mailboxes were made from empty plastic jugs and every house had at least three birdfeeders in the front yard. These birdfeeders are also made from plastic jugs.

I had seen for myself just how the people of Have None Island live. They simply use everything over and over again. I still had one more question. I wondered how the people had fun and celebrated on the island of Have None. On my last night there I was to find out. That night a friend we had made on the island came to our ship to invite us to a celebration.

"What are you celebrating?" I asked.

"We're celebrating the end of five good years of living; tomorrow our supply ship should be here," replied my friend.

"That's a celebration we'd like to be a part of", the men cheered.

As we approached the beach where the party was going on, we could hear music. The sounds of drums, flutes and even guitars sang out in the dark. I was amazed when I saw that even the people's instruments were not new, but made from old soda pop and vegetable cans, old metal pipes, boxes and plastic jugs. There was a girl shaking a rattle made from bottle tops, and a boy plucking a guitar made from a milk carton. The flutes were made from pieces of metal pipe and the drums were made from cans and bottles and boxes.

These were happy people on the Island of Have None. It isn't true that they Have None. In fact, they have all they need, because they have learned to reuse and reuse again. I think I will make the trip again across the dangerous ocean to visit these people...and I think I'll give the Island a new name.

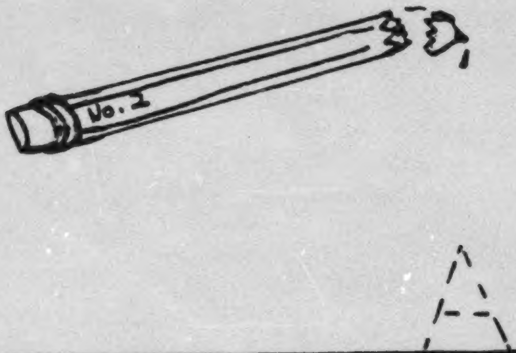
What do you think the new name of the Island should be?

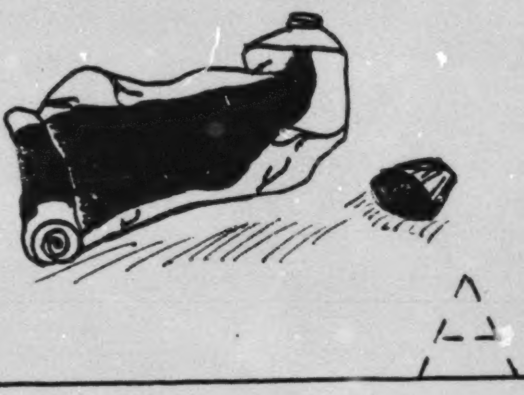
After re-naming the Island you may have the children draw a sketch of what they think the Island looks like. (Have the children draw the sketch on a scrap sheet of paper.)

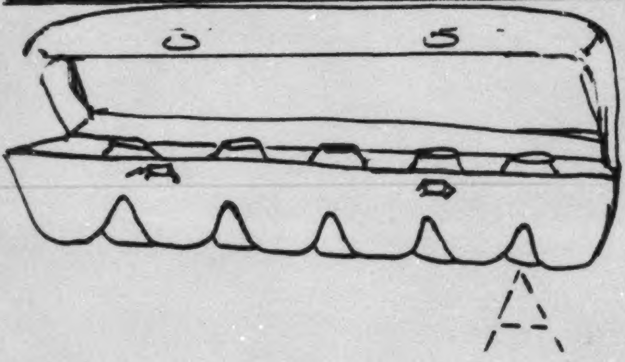
WHAT CAN BE USED AGAIN?

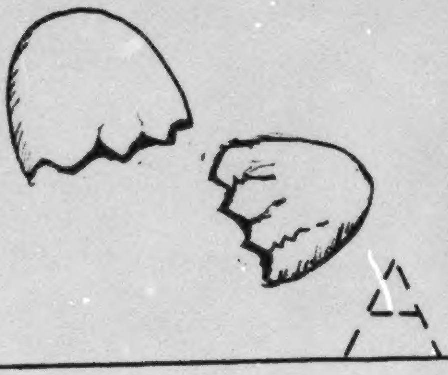
K - III - 1

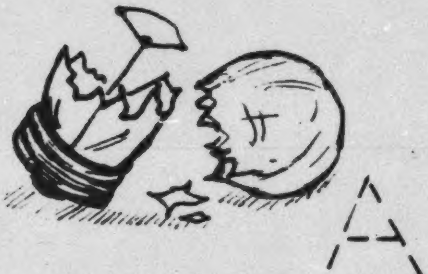
Complete the 'A' for again on the sketches of trash that can be reused.

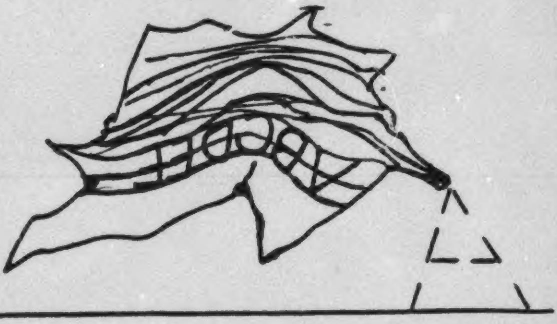


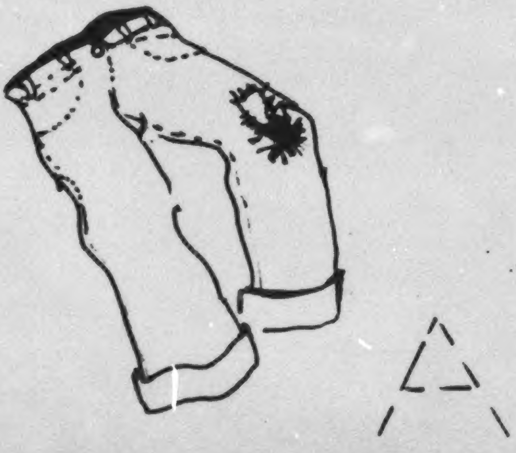


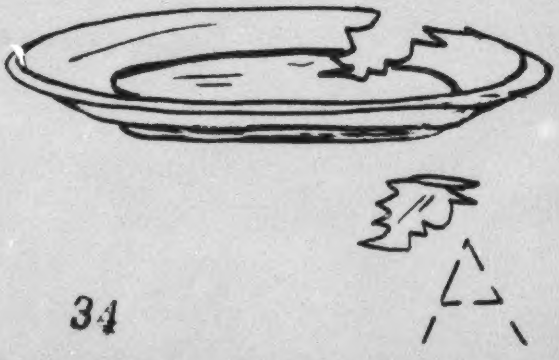








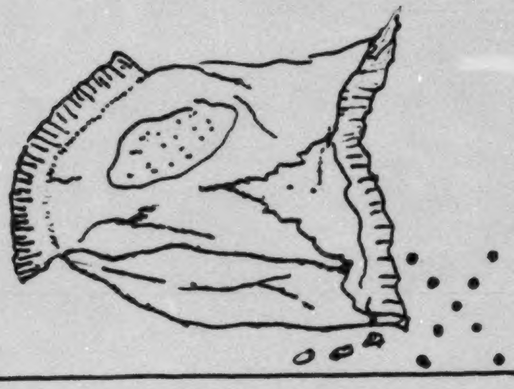


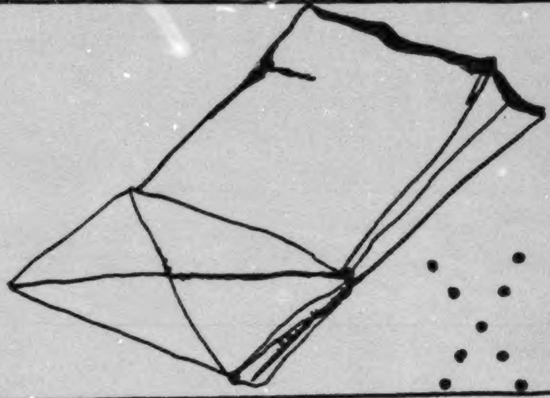


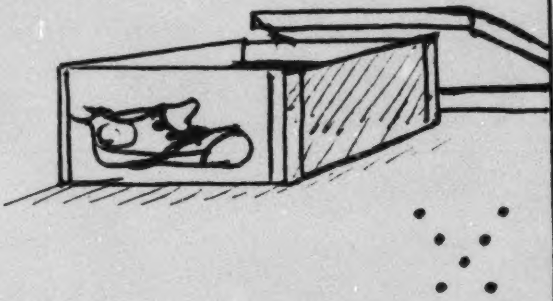
WHAT TRASH CAN NOT BE USED AGAIN?

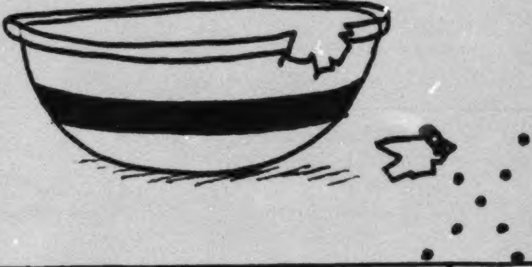
K - III - 2

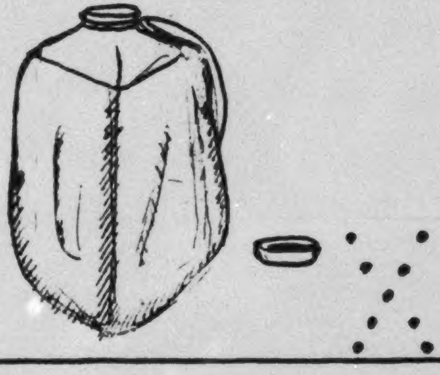
Complete the 'X' on the sketches of trash that can not be reused.

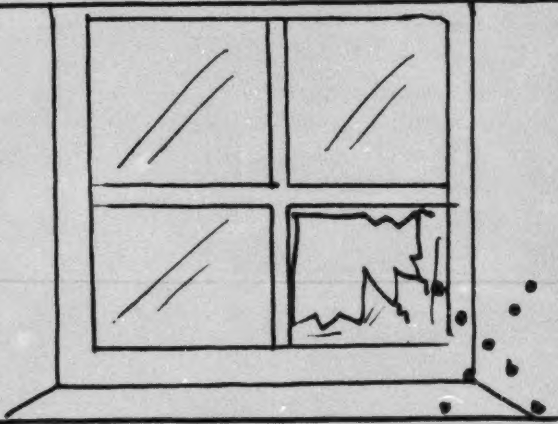


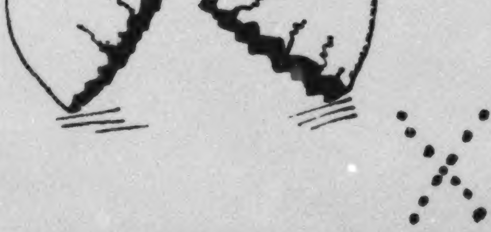


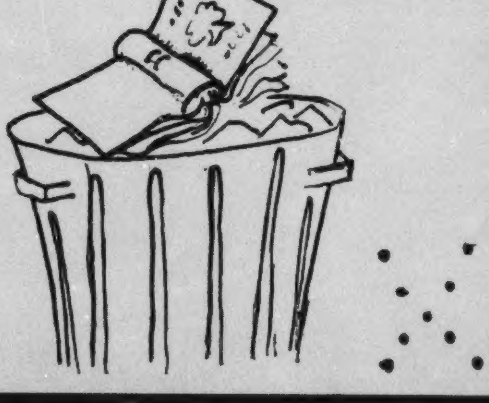








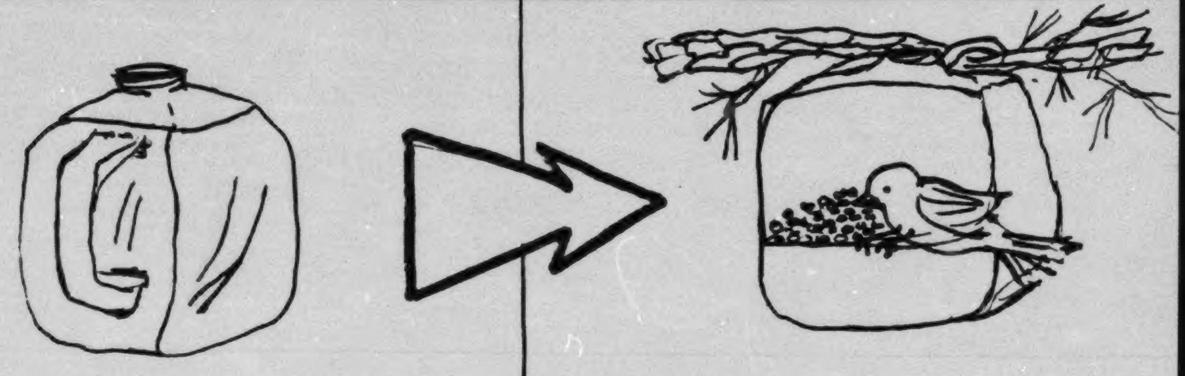


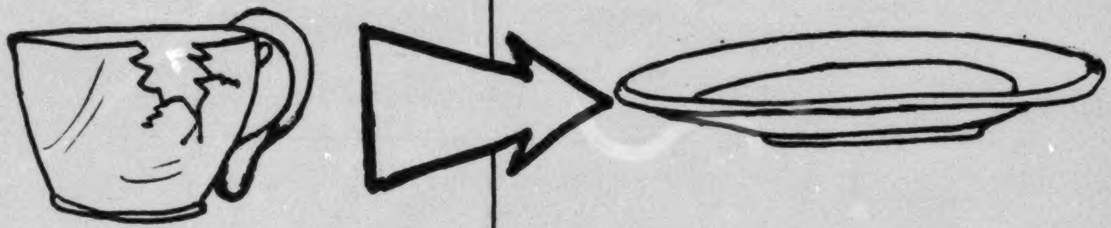


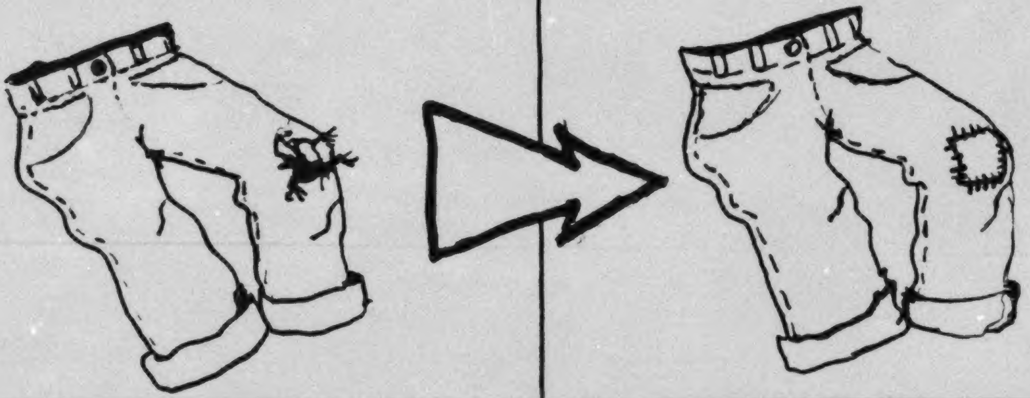
WHICH SKETCH IS WRONG?

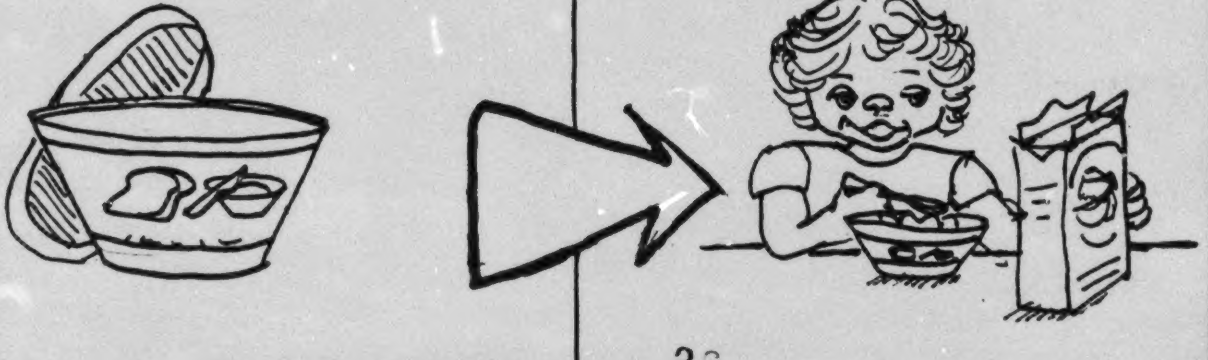
K - III - 3

Draw an 'X' on the arrow if the trash item in the left sketch can not be reused as shown in the sketch on the right.



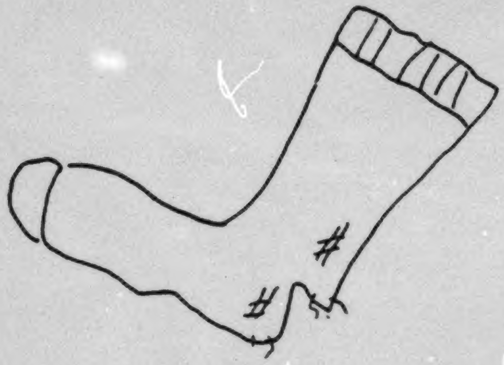


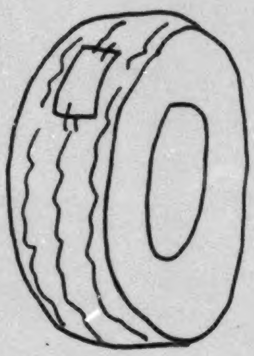


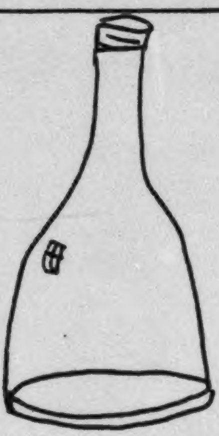


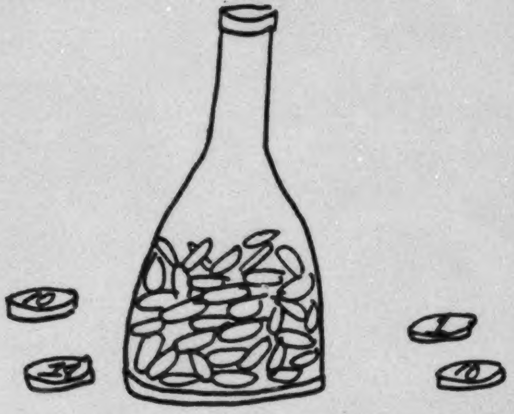
MATCH THE PICTURES.

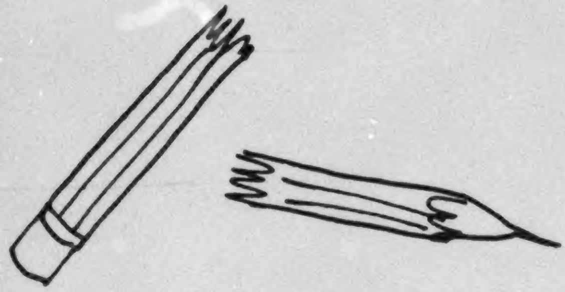
Color each piece of trash on the left a different color. Color the trash item being reused on the right the same color that would match the color of the item on the left.

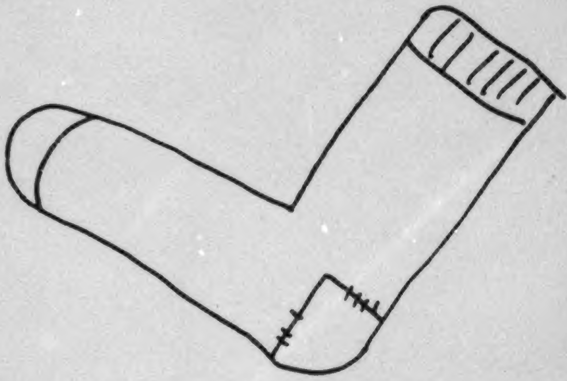


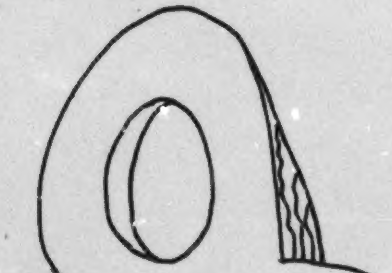


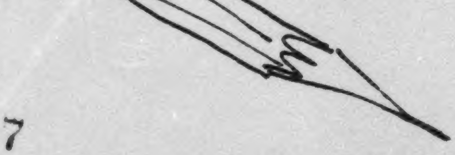






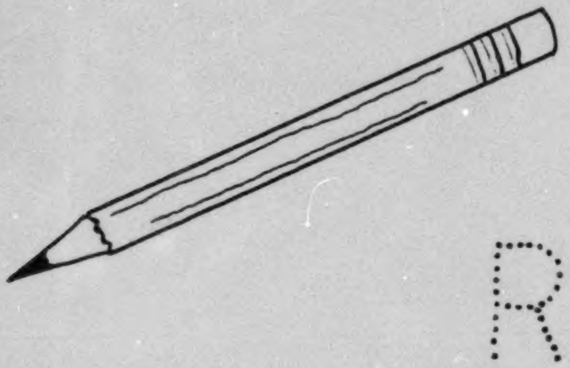


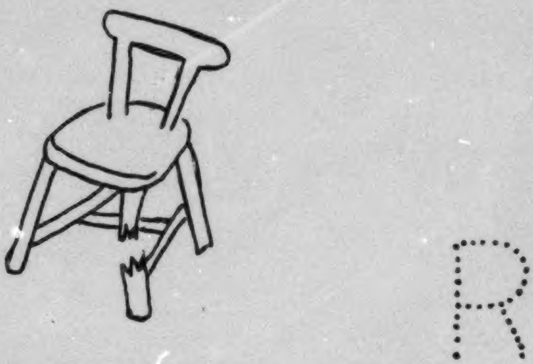


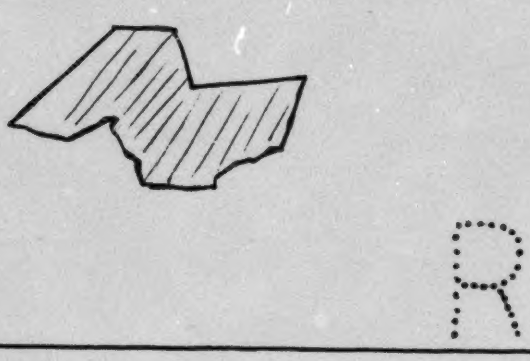


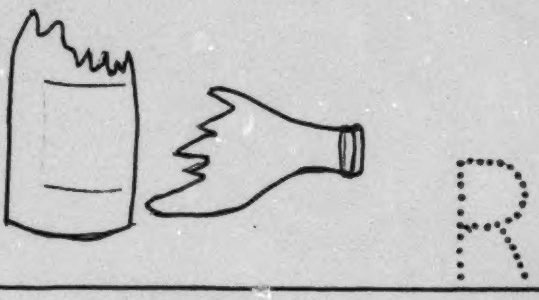
"R" IS FOR REUSE.

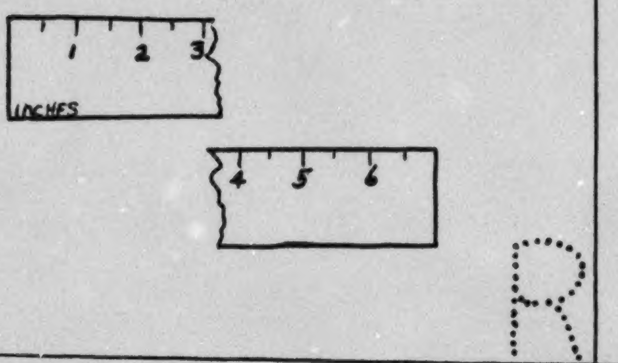
Complete the 'R' on the sketches of trash found in the classroom that can be reused.

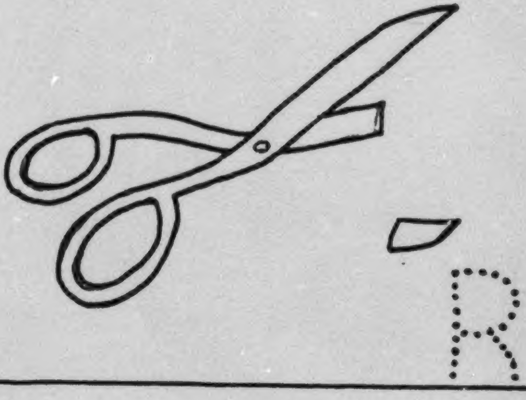


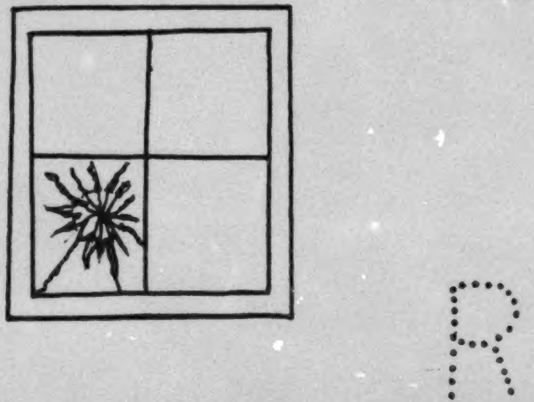


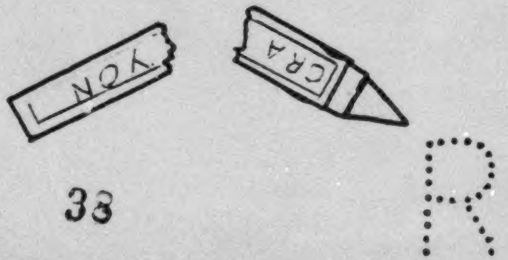





1
2
3
INCHES
4
5
6
R

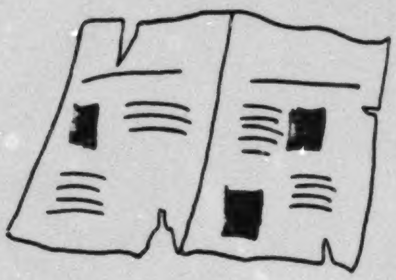






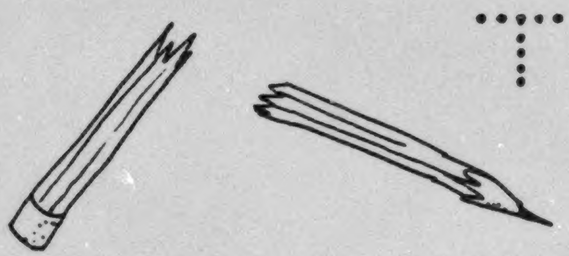
TRASH OR REUSE?

Complete either the letter 'T' for trash or 'R' for reuse on each sketch depending on whether the item should be placed in a trash container or reused.



T

R



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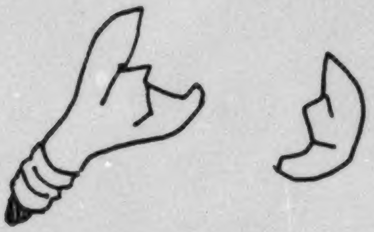

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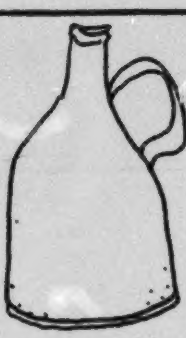

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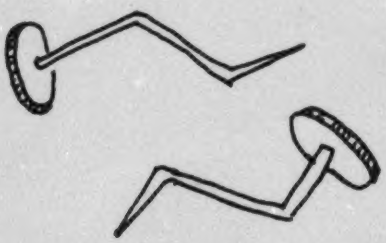

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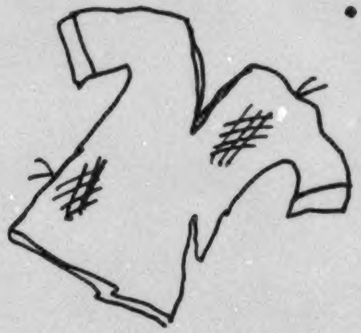

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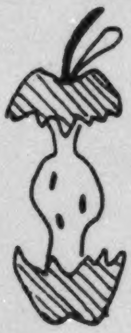

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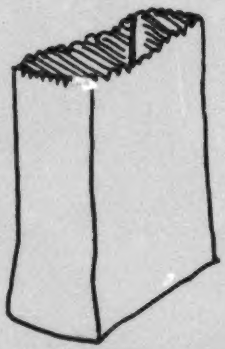
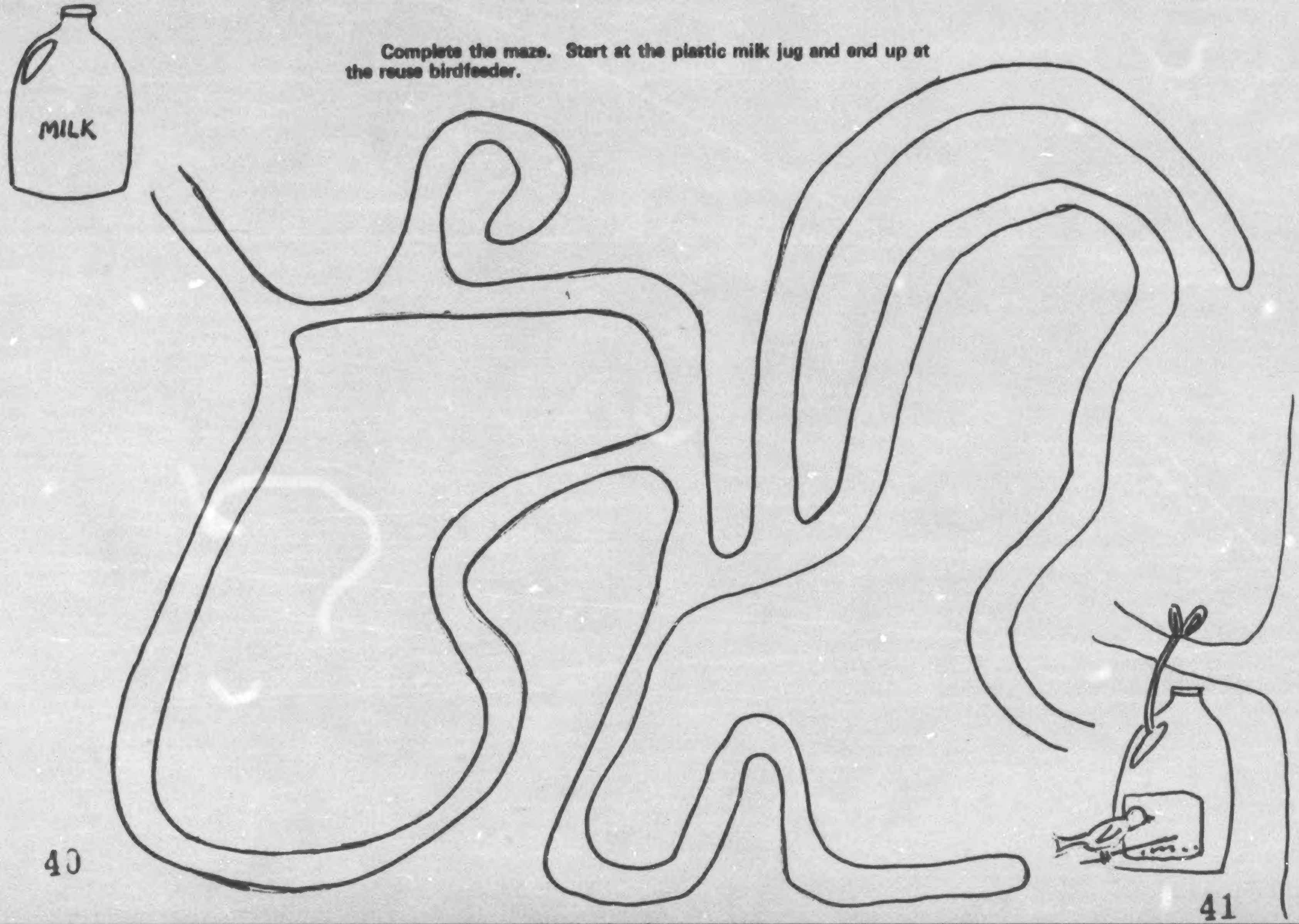


T

R

FOLLOW THE REUSE MAZE.

Complete the maze. Start at the plastic milk jug and end up at the reuse birdfeeder.



3. If the item is too heavy, place the item on a table or on the floor under the tree.
4. After all the children have had a chance to "show and tell" their trash items, be sure that each trash item has been attached to the trash tree. You may take this opportunity to emphasize the important concepts brought out in the "show and tell" discussion.
5. Utilize the worksheets as desired.

Children's Worksheets For The Trash Tree Unit II

What Is Home Trash?
Have the children complete the 'H' on the sketches that show trash found in the home. *K-II-1.*

What Isn't Home Trash?
Have the children complete the 'X' on the sketches that do not show trash found in the home. *K-II-2.*

Determining Between Kitchen and Bathroom Trash.
Have the children complete either the letter 'K' for kitchen or 'B' for bathroom under each sketch depending on what room the child would find the trash in the sketches. *K-II-3.*

Which Trash In Which Rooms?
Have the children draw an arrow from each sketch of trash to the room in which that trash would be found. *K-II-4.*

Where Do We Find Trash?
Have the children complete the 'T' on the sketches where they see trash. *K-II-5.*

Good Ways And Bad Ways To Take Care Of Trash.
Have the children complete the letter 'G' for good or 'B' for bad under each sketch depending on whether or not the child feels the trash is being taken care of properly. *K-II-6.*

III. LET'S USE IT AGAIN TREE

The Preparation:

The object of this lesson is to show the children that much of the trash on their classroom trash tree can be used again. To get the reuse idea across show them samples such as:

1. A broken crayon can still be used.
2. An old pencil which may still be used a little longer.
3. Discarded paper used on one side may be used again.
4. Plastic containers may be used as storage containers and also arts and crafts projects such as: birdfeeders, piggy banks, etc. *(See Unit B for Grades 3 and 4).*

Read the story of "The People of Have-none Island." Get the children to help identify all the situations in the story where something is being reused.

The Action:

1. Drawing or providing another tree is optional.
2. Review each item of trash on the trash tree(s) with the class.
3. Conduct a discussion about the reuse possibilities of items on the tree(s).
4. Remove the items which may be discarded and leave hanging only the items the class has decided can be used again.
5. Have different members of the class explain how one of the items remaining on the trash tree can be used again.
6. You may use the worksheets as desired.

Children's Worksheets For Let's Use It Again Tree Unit III

What Can Be Used Again?
Have the children complete the 'A' for again on the sketches of trash that can be reused. *K-III-1.*

What Trash Can't Be Used Again?
Have the children complete the 'X' on the sketches of trash that can't be reused. *K-III-2.*

Which Sketch Is Wrong?
Have the children draw an 'X' covering the arrow if the trash item in the left sketch cannot be reused as shown in the right sketch. *K-III-3.*

Match The Pictures With Colors.
Have the children color each piece of trash on the left a different color. Color the trash item on the right which can be reused the same color. *K-III-4.*

'R' Is For Reuse.
Have the children complete the 'R' on the sketches of trash found in the classroom that can be reused. *K-III-5.*

Trash Or Reuse.
Have the children complete either the letter 'T' for trash or 'R' for reuse under each sketch depending on whether the item sketched should be placed in the trash container or whether it can be reused. *K-III-6.*

Follow The Reuse Maze.
Have the children complete the maze. They should start at the plastic milk jug and end up at the reuse birdfeeder. *K-III-7.*

IV. WHAT DO I FEEL?

The Preparation:

1. For this lesson you will need twelve paper lunchbags or twelve paper shopping bags.
2. You will need to get twelve items that are usually found in the home or school. The items do not need to be trash.
   a. Two different wood items.
   b. Two different glass items.
   c. Two different metal items.
   d. Two different plastic items.
   e. Two different cloth items.
   f. Two different paper items.

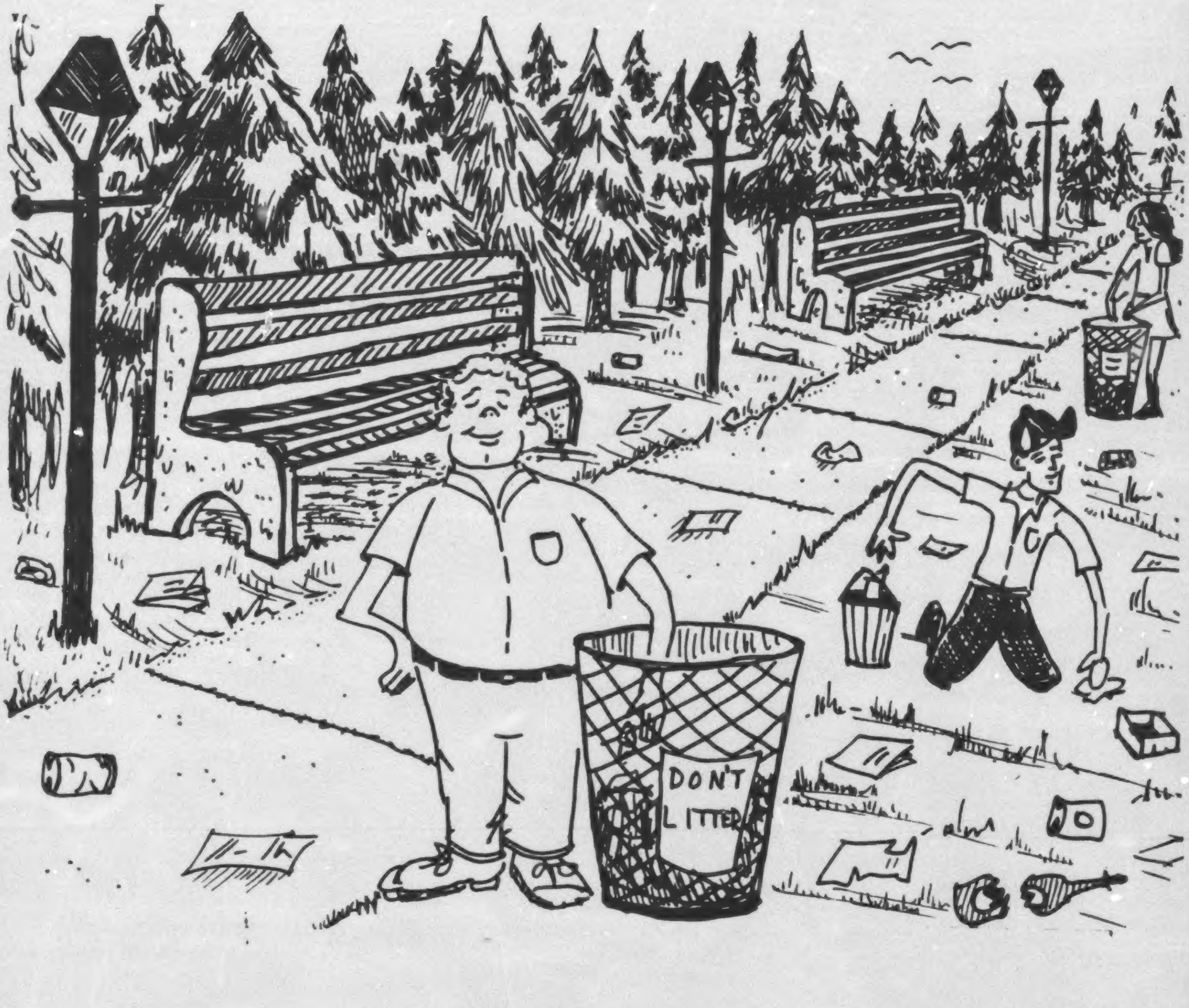
The Action:

1. Place each of the items in a separate bag.
2. Explain to the students that most of the trash on the trash tree(s) were either wood, glass, metal, plastic, cloth or paper. Show an example of each kind of material. (You may spell each word on the blackboard or bulletin board if desirable.)
3. Leave your headings on the top of the blackboard/bulletin board if you spelled them out.
4. Have the children, one at a time, come to the front of the class.
5. Have the first child feel inside bag number one. Do not let the child see what is in the bag.
6. Write number one (which stands for bag No.1) under the heading on the blackboard/ bulletin board which the student selected as the kind of material he/she felt.
   a. Have the child describe what he/she feels in the bag.
   b. Classify the type of material correctly.
   c. Can they name anything else that is made from the same material they felt?
   d. Can they name anything they see in the class that is made from the material they felt?
7. Have the second child come to the front of the class and feel inside bag number two. Have the child answer the above questions. Have the third child feel inside bag number three. When you get to child number thirteen, go back to bag number one and so on.
8. After each student has had a chance to feel inside a bag, show the class what is in each bag.

SOLID WASTE/ENERGY CURRICULUM

GRADE 1

TRASH IS BETTER THAN LITTER


DON'T LITTER

UNIT I - EVERYONE MAKES TRASH - - SOME PEOPLE MAKE LITTER

The Strategy of Instruction

There are two big ideas dominating this unit. The first is the idea contained in the title. The second is that all trash belongs in a suitable container. These ideas are interwoven with opportunities to practice desired first grade skills such as addition, telling time, reading, distinguishing right from left, and sets.

The Action

It is suggested that teachers use blackboard sketches, display charts or flannel boards to illustrate the ideas contained in the children's activity pages. Some continuity of thought is embodied in the sequence of the activities. The teacher may, however, defer the selection of some of the activities for other times judged to be more feasible.

Children's Worksheets

Trash is what we don't need any more and throw (place) into an appropriate container. Trash becomes litter when it is thrown onto the floor or ground. *1-I-1.*

Lots of us feel bad to see litter lying around. Most of us feel good when trash is in its place. *1-I-2.*

Everyone makes trash and many people make litter. Some people make more litter than others. When people throw trash on the ground they're called "Litterbugs". *1-I-3.*

The litter-trash distinction is reinforced. The positions of right and left are also distinguished. *1-I-4.*

Everyone makes trash, some people make more than others. These activity sheets have the children record the litter by placing the appropriate number on the face of a clock. *1-I-5.& 6.*

This is another clock activity that further distinguishes litter and trash. *1-I-7.*

Not all trash is the same. Some of the most common items in trash are bottles, cans, and paper. This idea is emphasized in an activity using recognition of sets. *1-I-8.*

UNIT II - ALL TRASH GOES SOMEWHERE

The Strategy of Instruction

In the previous unit an attempt is made to show that all people make trash, whereas some people produce litter. Trash is represented as throwaways placed in a proper container. In this unit an attempt is made to give the children an idea of where trash goes after it leaves the waste container in the home or school.

The Action and Children's Worksheets

This activity is intended to provide a recall of learnings provided in the first unit. *1-II-1.*

This spelling lesson helps children to recognize some of the more common categories of trash. There is also an opportunity to practice right and left orientation. *1-II-2 & 3.*

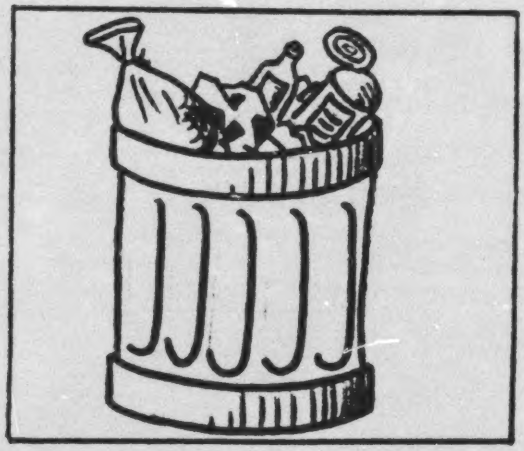
This math lesson analyzes the objects in a trash can and is combined with an exercise with colors. *1-II-4 & 5.*

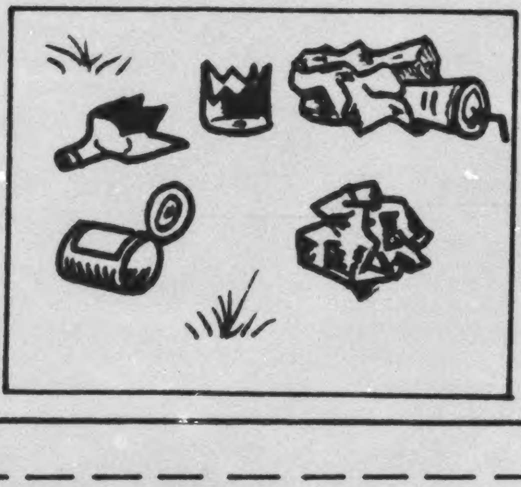
Trash ☞ Things we do not need any more and are put in a can.

Litter ☞ Trash that has been thrown on the floor or ground.

Write the word Trash under the picture of trash.

Write the word Litter under the picture of litter.



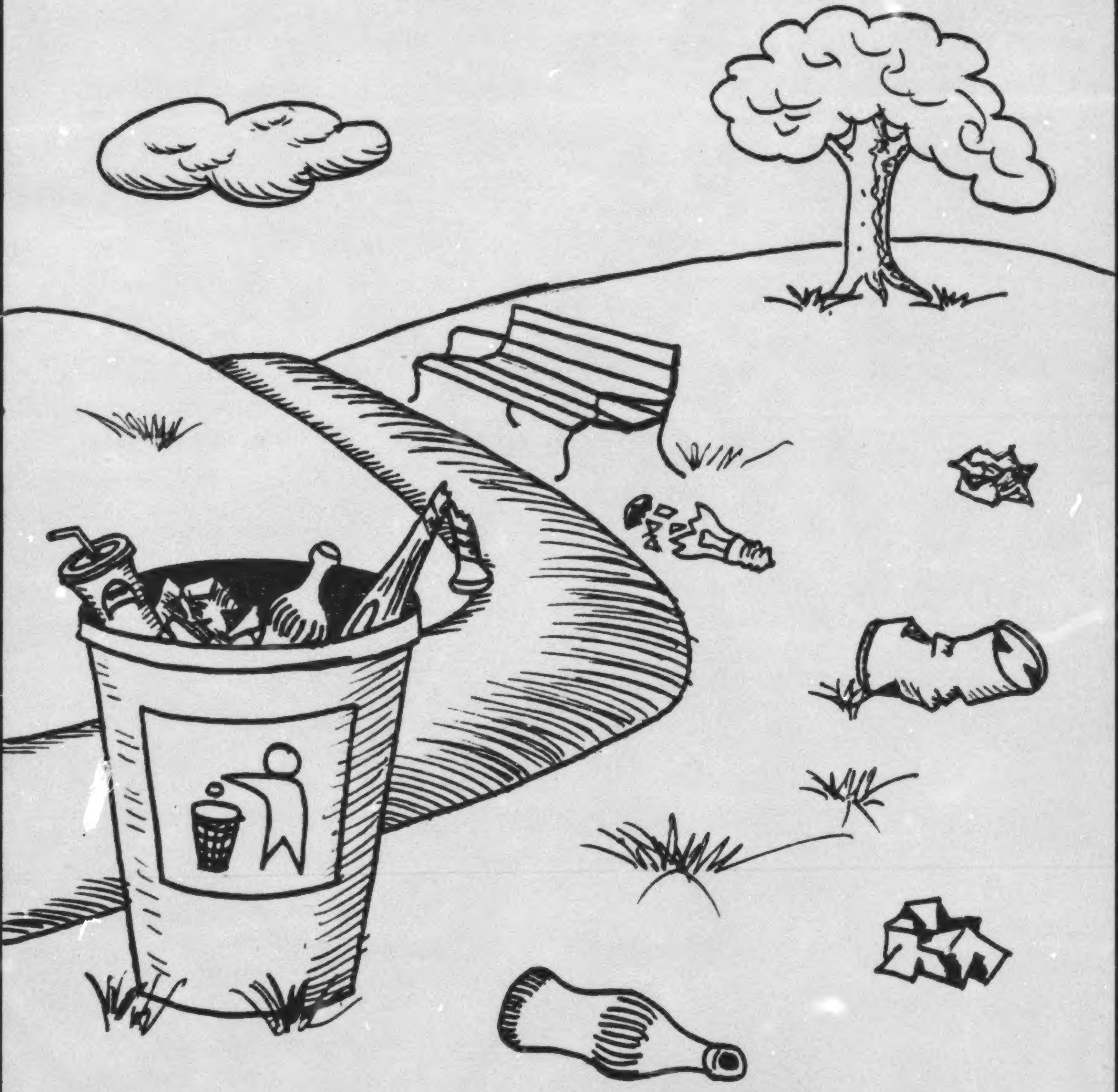


Count the pieces of trash in the picture.

Color the trash a happy color.

Count the pieces of litter in the picture.

Color the litter a sad color.



X MARKS THE LITTERBUG

1-1-3

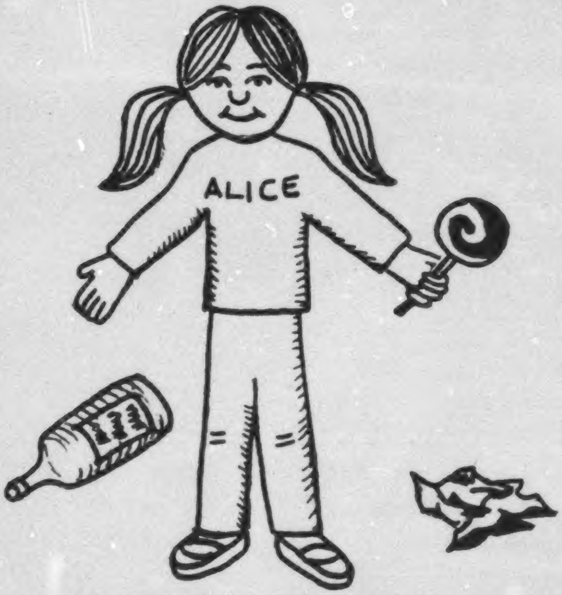
Put an X next to the person's name who made the most litter.

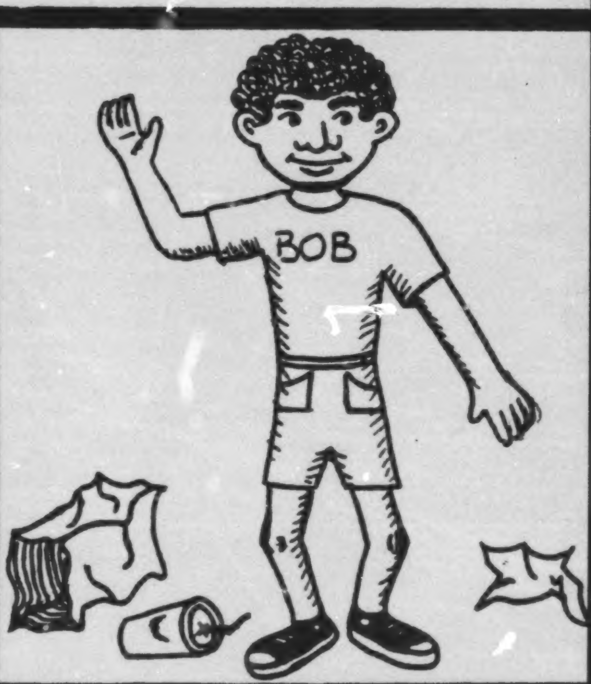
Alice

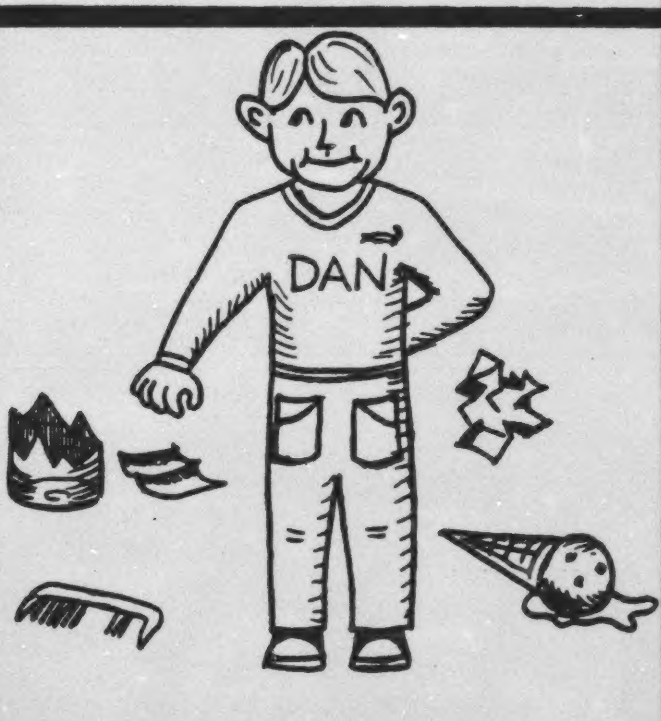
Bob

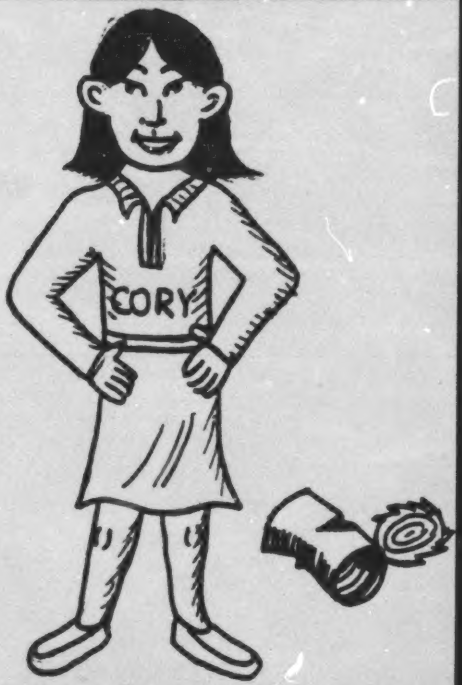
Cory

Dan









LITTER TO THE LEFT–
LITTER TO THE RIGHT

1-1-4

Look at the litter around the trash can.

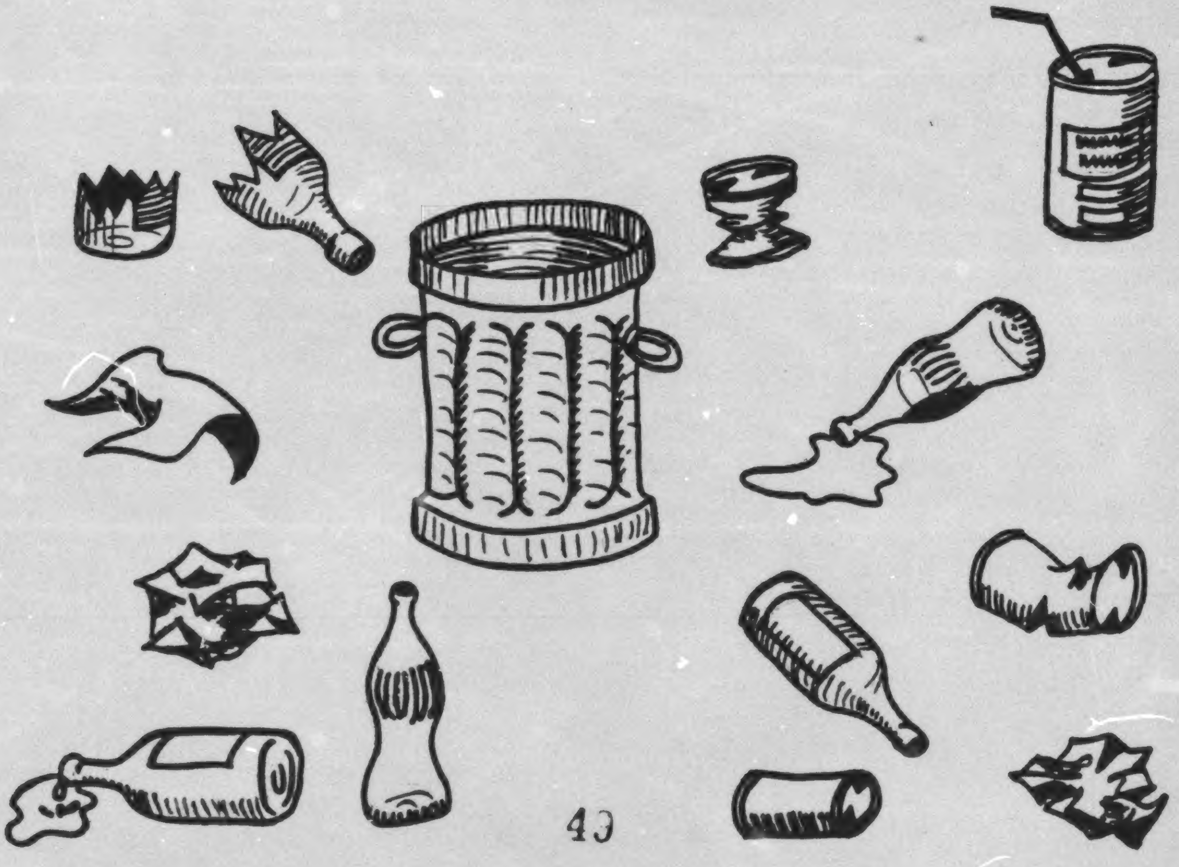
How many bottles are on the right? _____

How many cans are on the right? _____

How many pieces of paper are on the left? _____

How many bottles are on the left? _____

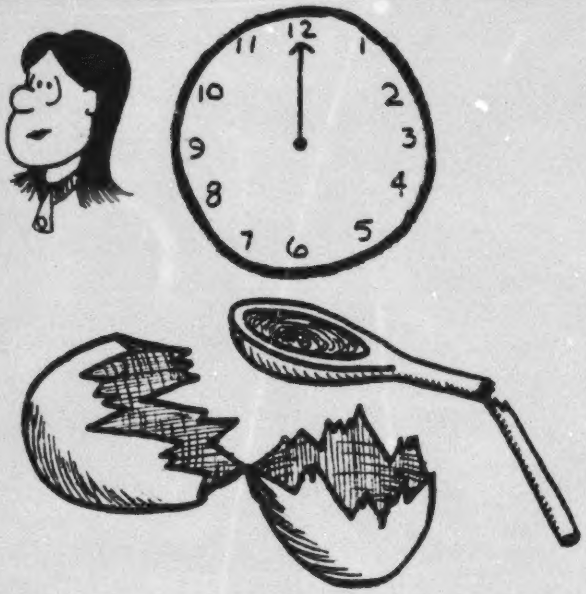
How many pieces of litter are around the trash can? _____



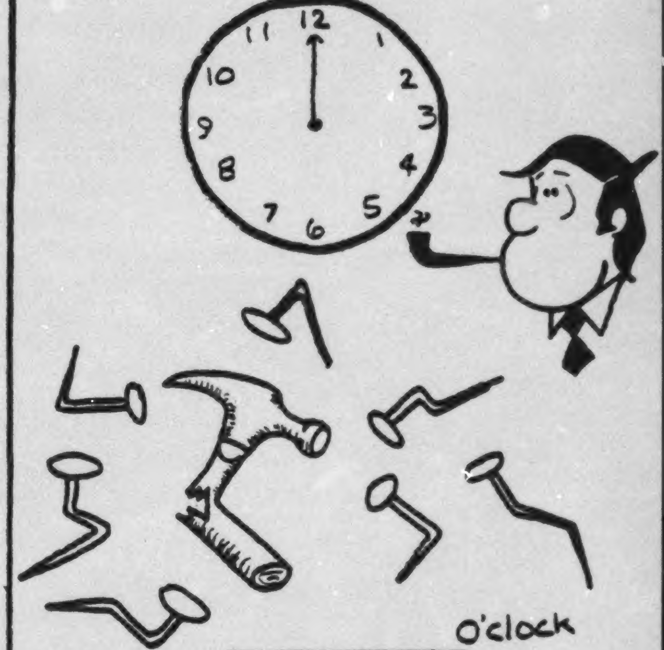
TRASH EVERY HOUR

1-1-5

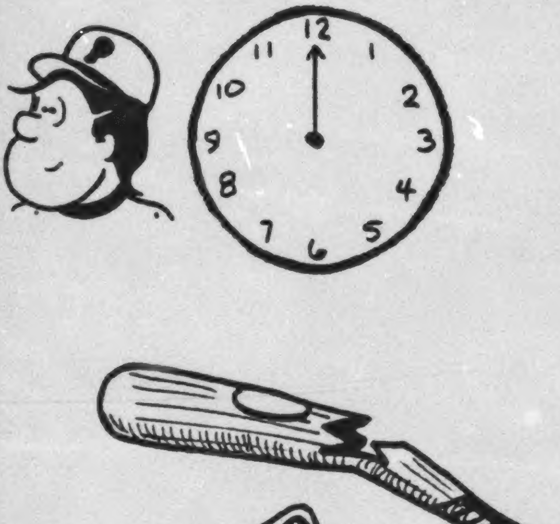
Directions: This whole family made trash. Count the pieces of trash each person made. Draw an hour hand on the clock pointing to that number. The minute hand is already on the clock. After you put the hour hand on, write under each person's trash what time their clock says.


12 1 2 3 4 5 6 7 8 9 10 11

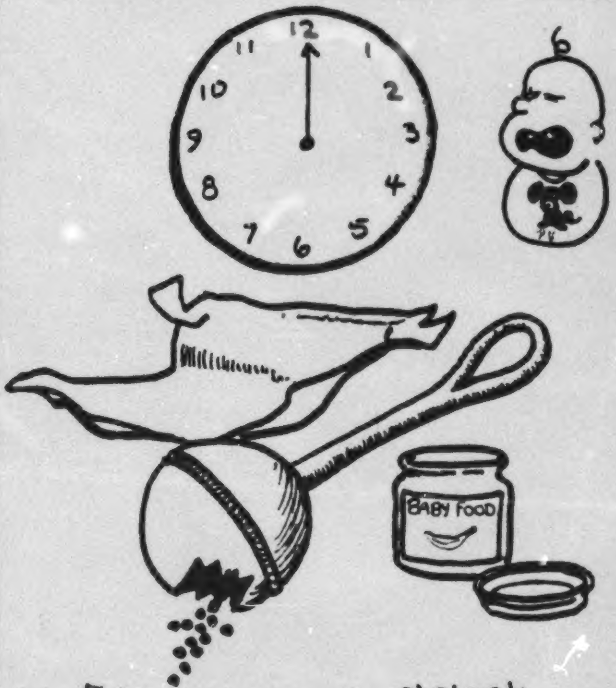
________ o'clock


12 1 2 3 4 5 6 7 8 9 10 11

________ o'clock


12 1 2 3 4 5 6 7 8 9 10 11

________ o'clock

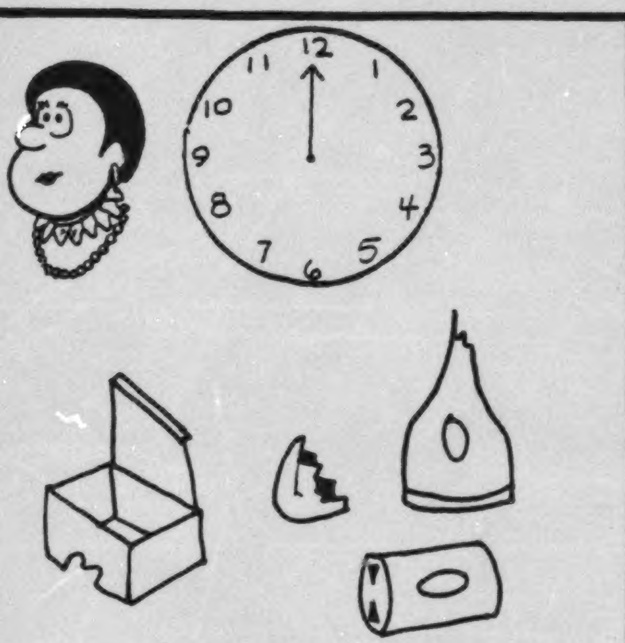

12 1 2 3 4 5 6 7 8 9 10 11
BABY FOOD

________ o'clock

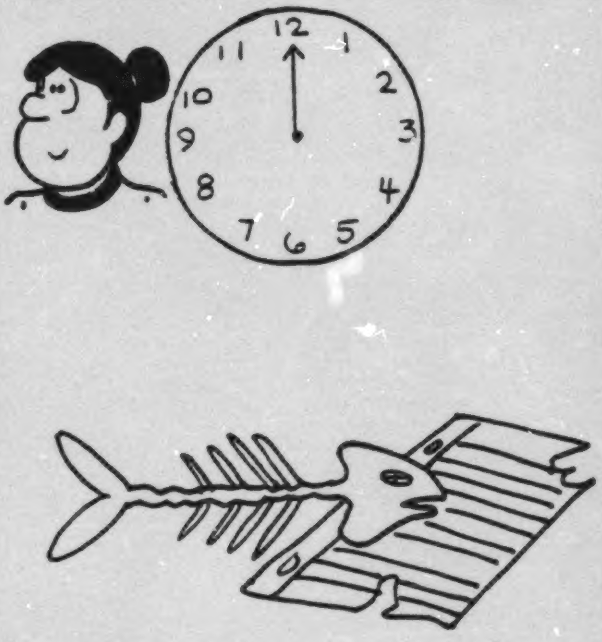
TRASH EVERY HOUR

1-1-6

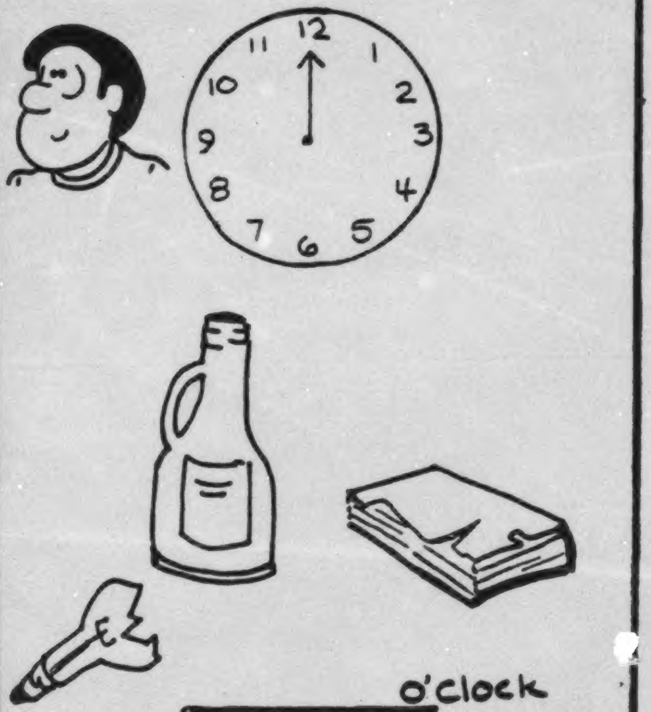
Directions: This whole family made trash. Count the pieces of trash each person made. Draw an hour hand on the clock pointing to that number. The minute hand is already on the clock. After you put the hour hand on, write under each person's trash what time their clock says.



________ o'clock



________ o'clock



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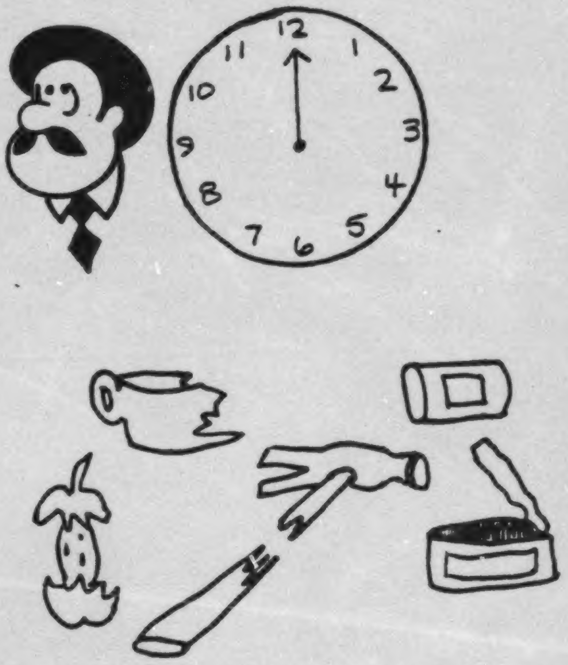
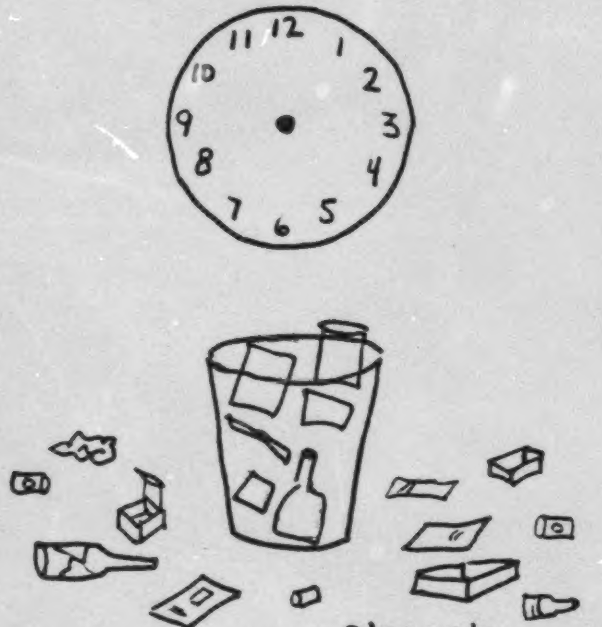


________ o'clock

HOURS OF TRASH
MINUTES OF LITTER

1-4-7

Directions: Count the pieces of trash. Draw an hour hand on the clock pointing to that number. Count the pieces of litter. Draw a minute hand on the clock pointing to that number. What time does the clock say?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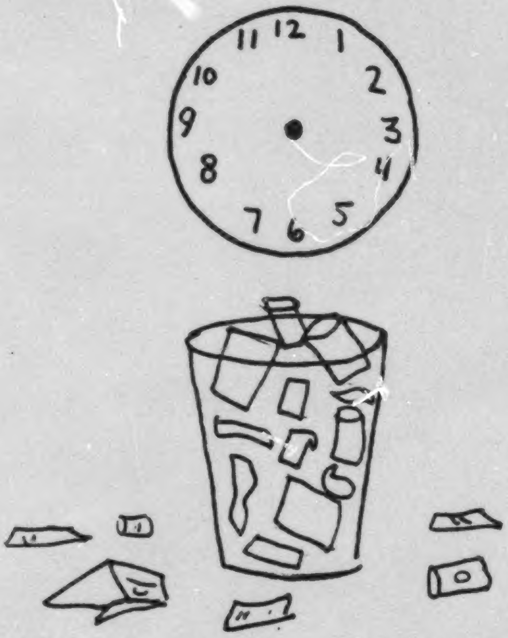
10
11

__________ O'CLOCK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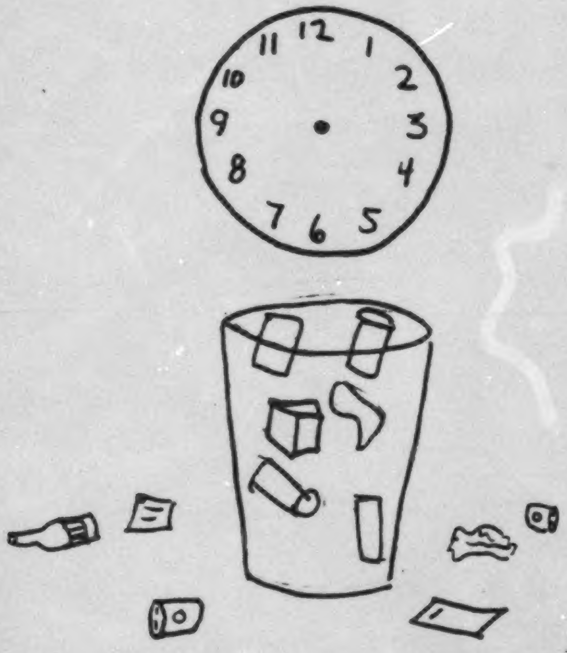
__________ O'CLOCK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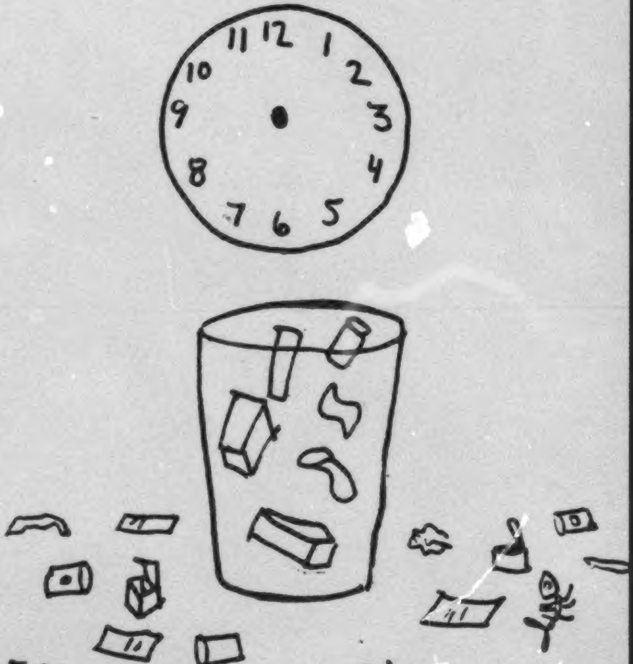
__________ O'CLOCK


12
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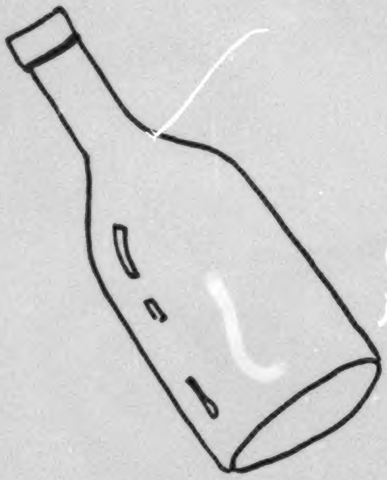
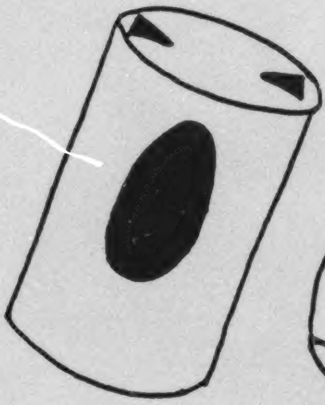
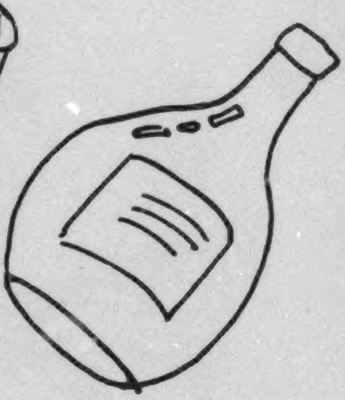
11

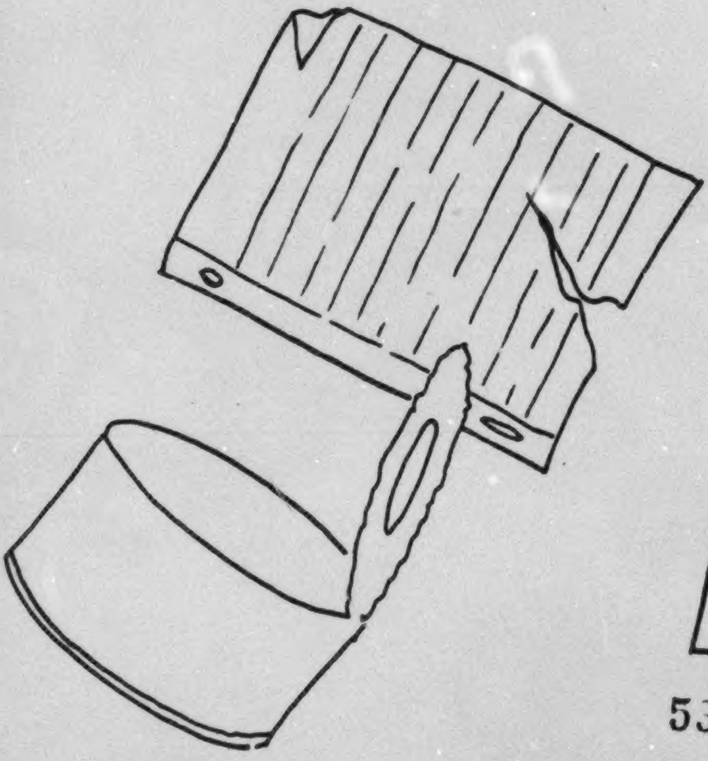
__________ O'CLOCK

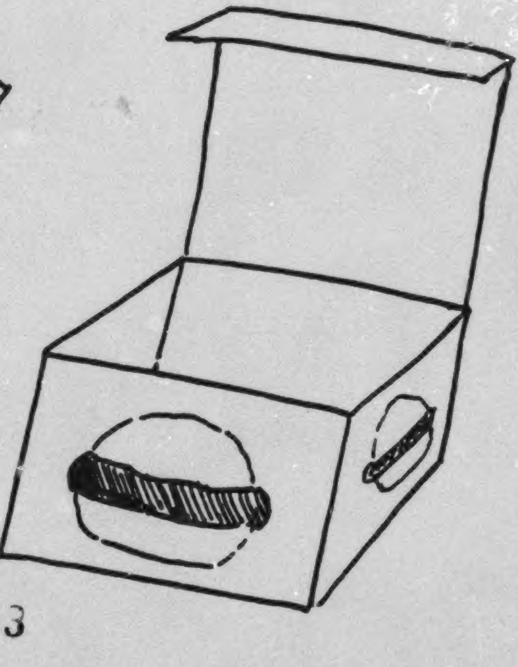
Some trash is made from glass. Some trash is made from metal. Some is made out of paper. Look at the pictures below. Color the GLASS trash RED. Color the METAL trash BLUE. Color the PAPER trash YELLOW.









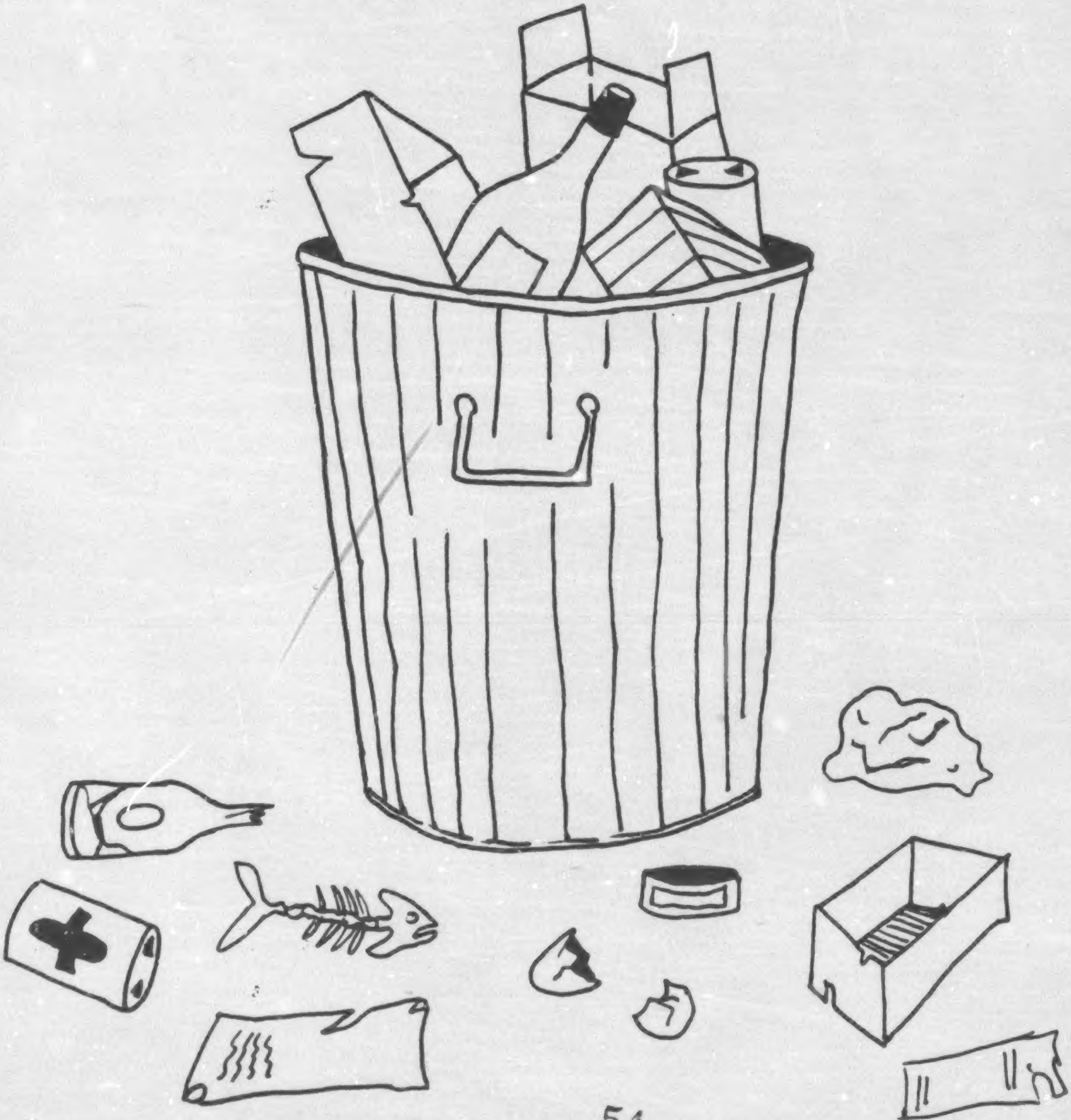


How many things in the picture are litter? _______

How many things in the picture are not litter? _______

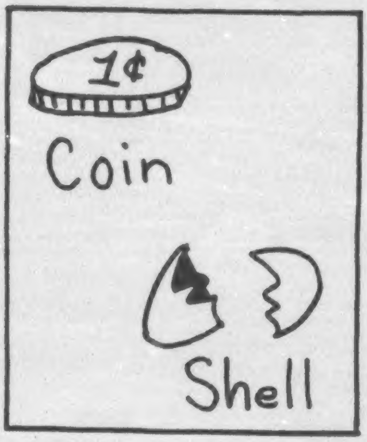
Color the litter a sad color.

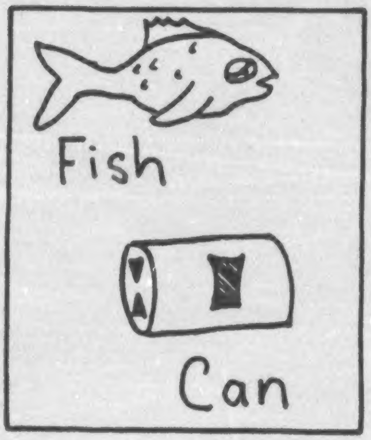
Color the other pictures a happy color.

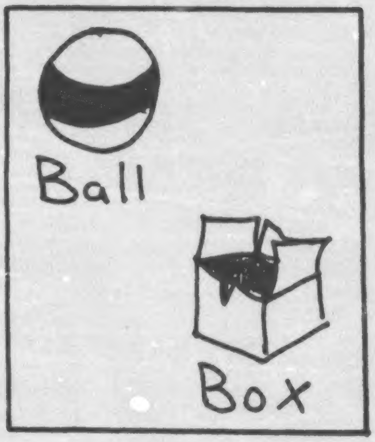


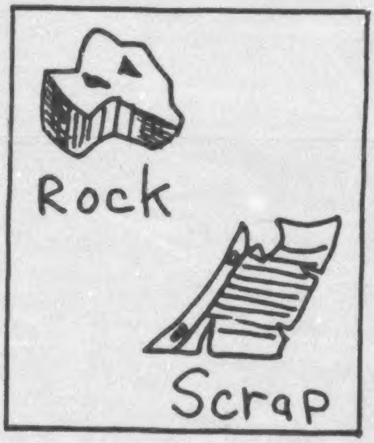
Look at the pictures and words in each box.

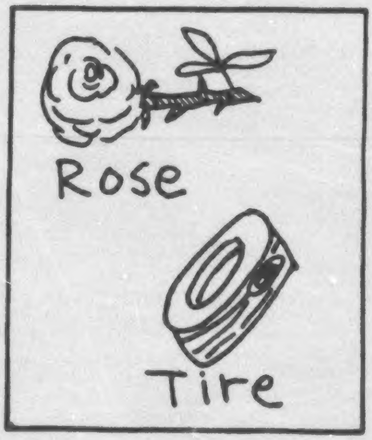
Write the word that is on the right.

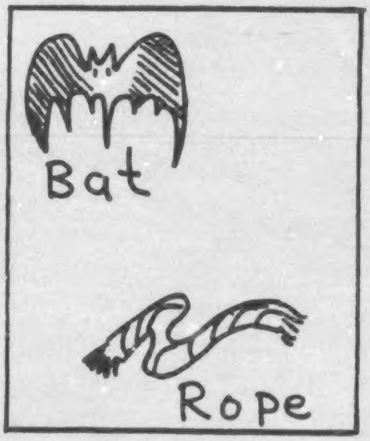

1¢
Coin
Shell







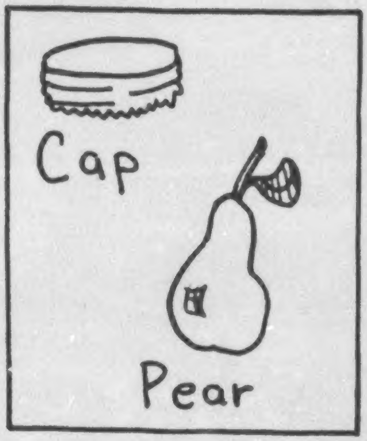


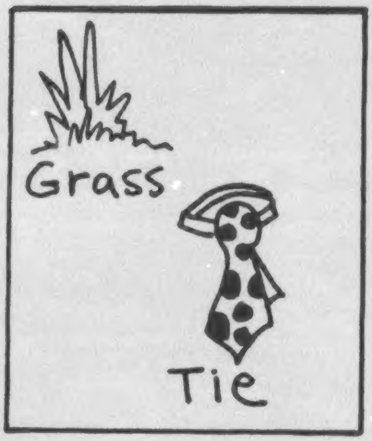


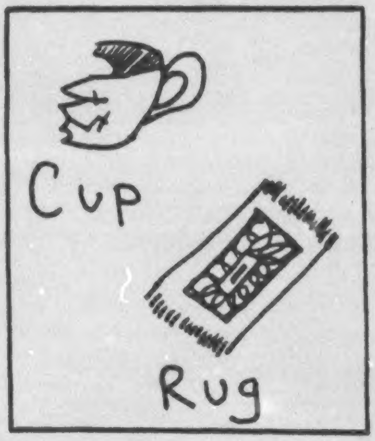
WHAT'S LEFT ?

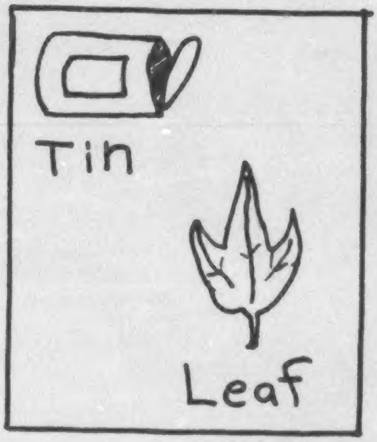
Look at the pictures and words in each box.

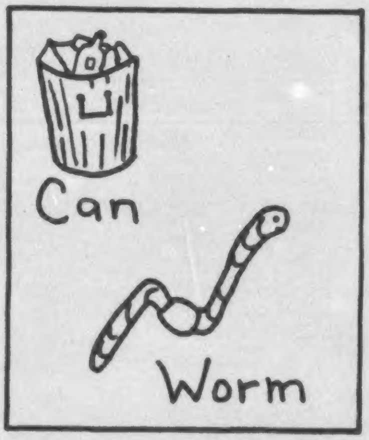
Write the word that is on the left.

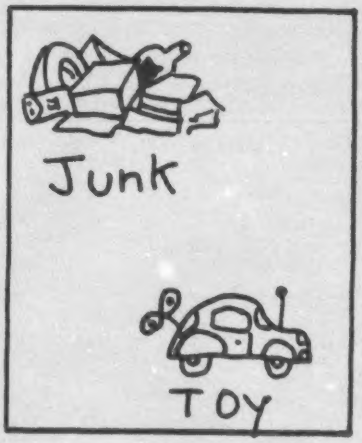




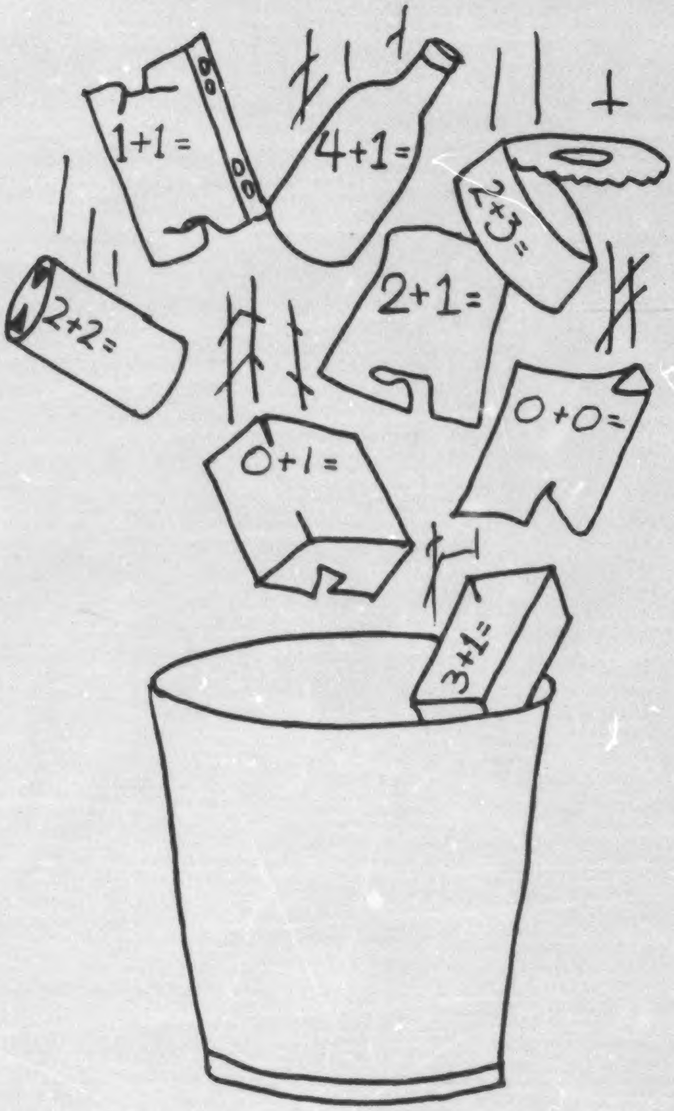








Do the addition problem on each piece of trash.

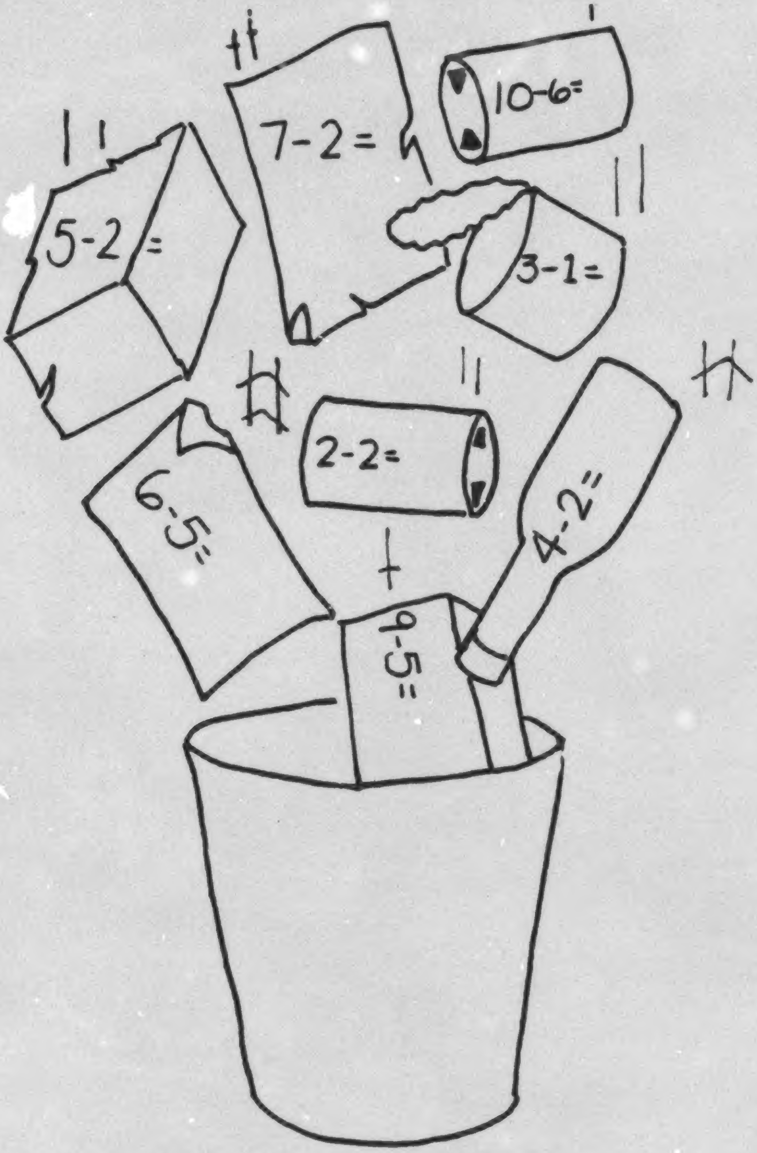


More: Use the color code to color each piece of trash.

Answer	Color
0	Purple
1	Green
2	Red
3	Yellow
4	Orange
5	Blue

SUBTRACTING THE TRASH

Do the subtraction problem on each piece of trash.



More: Use the color code to color each piece of trash.

Answer	Color
0	Purple
1	Green
2	Red
3	Yellow
4	Orange
5	Blue

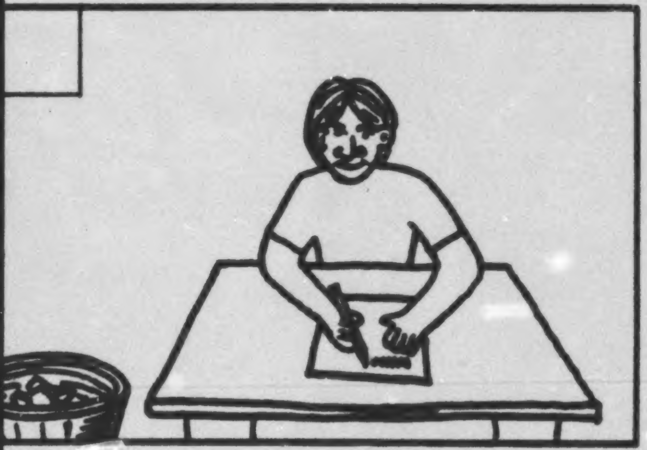
PUTTING TRASH IN IT'S PLACE

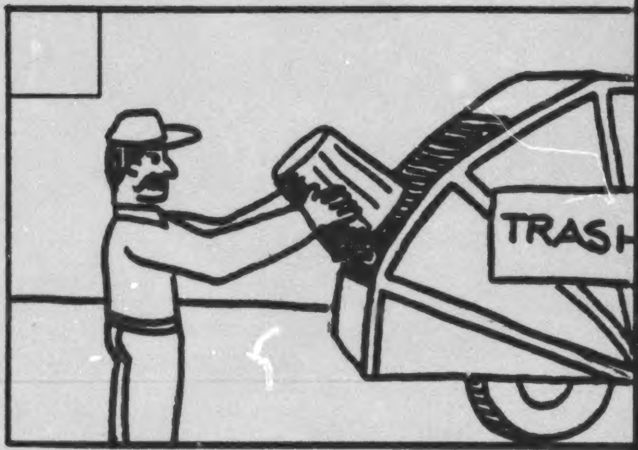
1 - II - 6

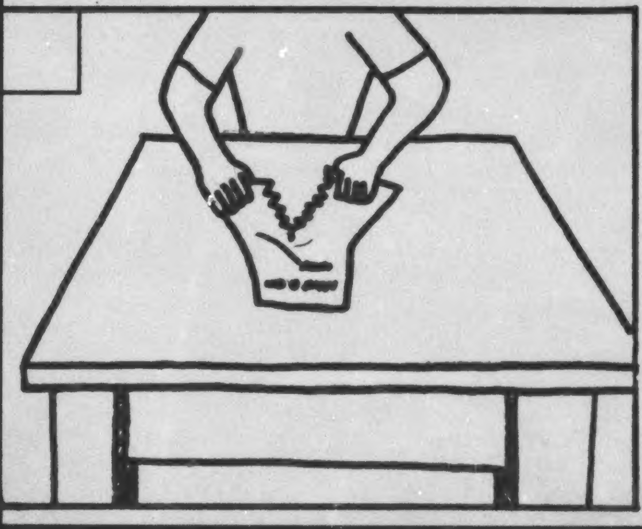
Directions: Read the story. Look at the pictures under the story. Put the pictures in order of how they happened in the story. Number them in the ☐ 1, 2, 3, or 4.

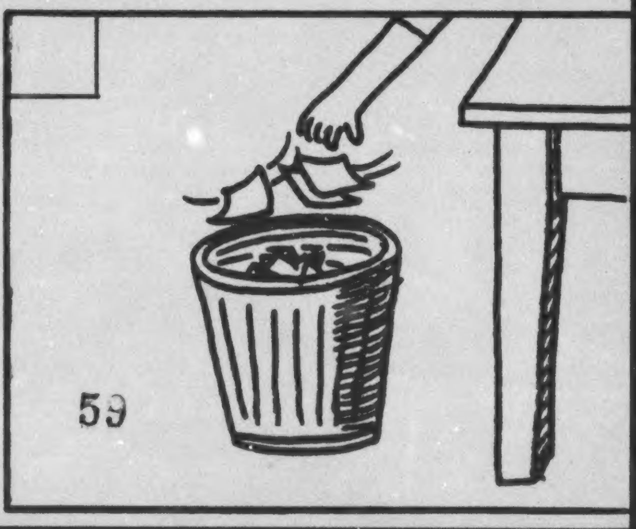
Juan is at his desk in school. He is writing sentences. Woops! Juan made a mistake on both sides of his paper. He tears the paper up and throws it in the trash can.

On Tuesday a trash truck comes and takes away all the trash.

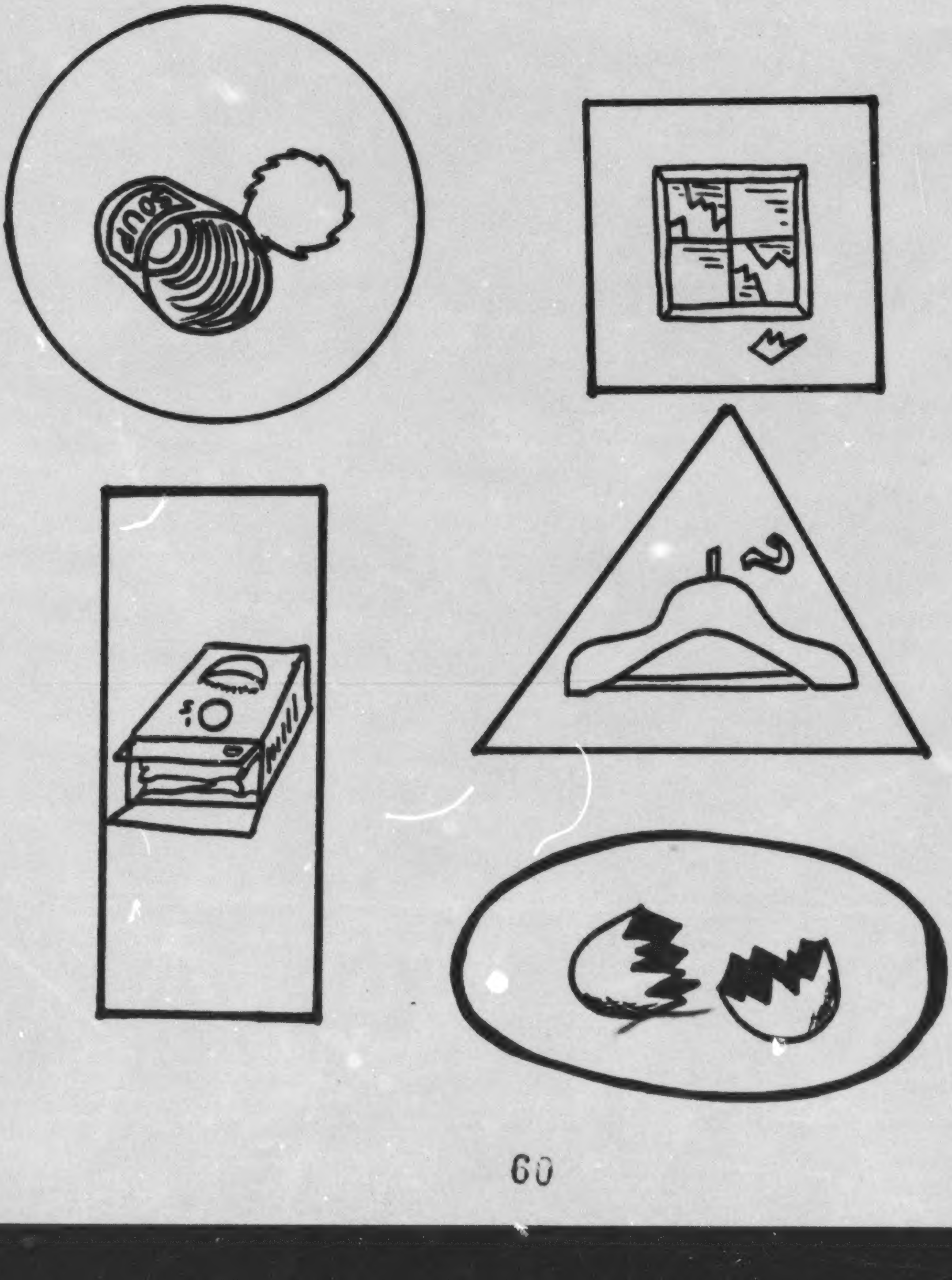








Color the trash inside the square....................red
rectangle.................blue
triangle...................orange
oval.........................brown
circle.......................green

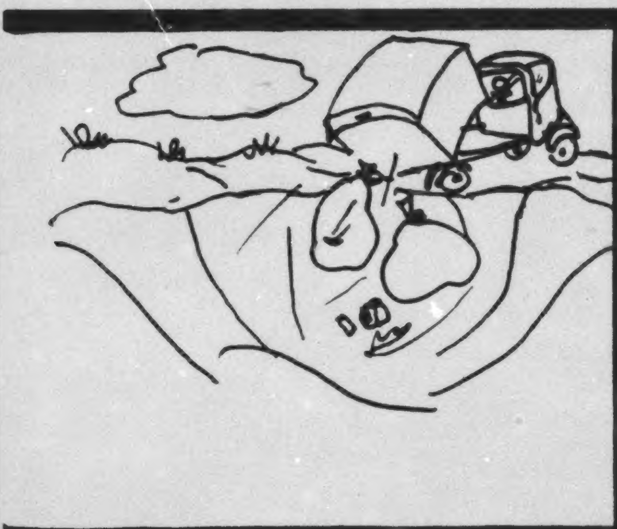


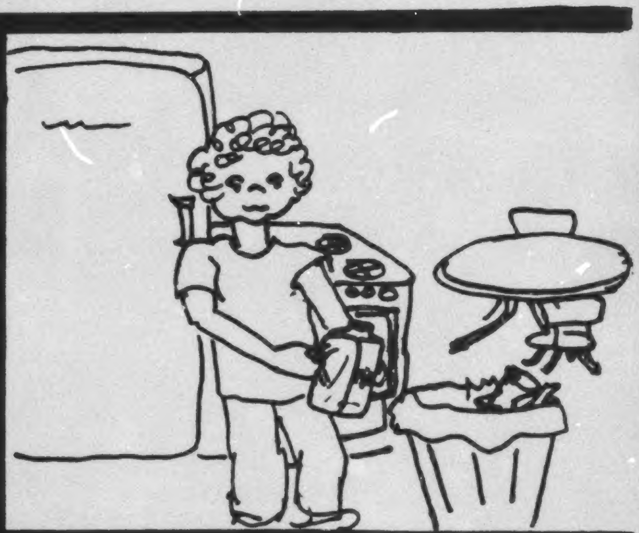
WHICH WAY TO THE DUMP ?

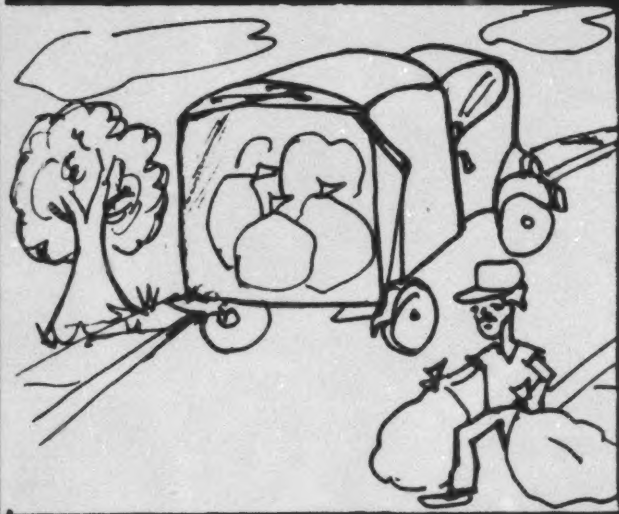
1 - II - 8

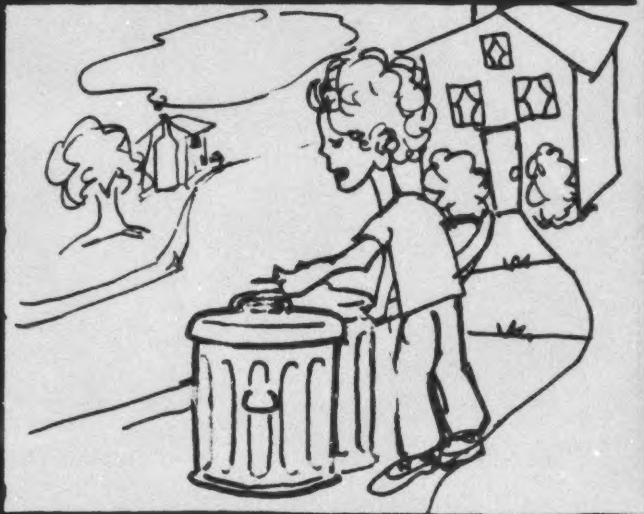
The pictures below show what happens to trash. Color the pictures.

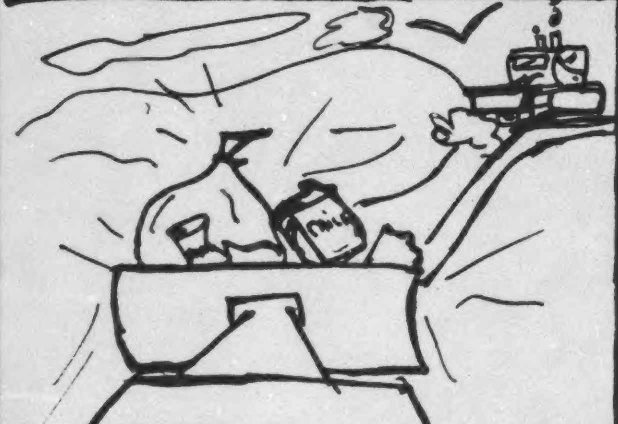
Cut the pictures out and place them in the proper order of how they happened.

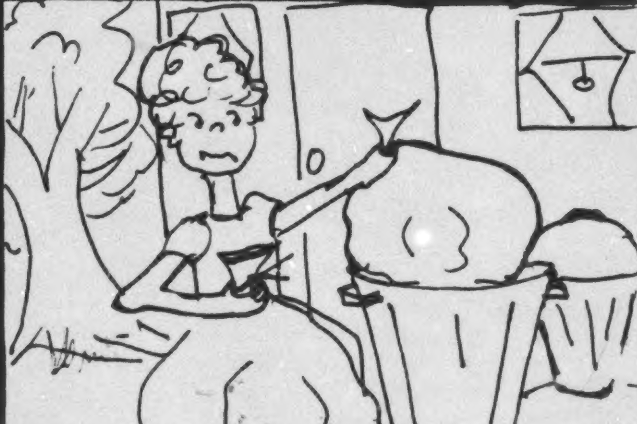




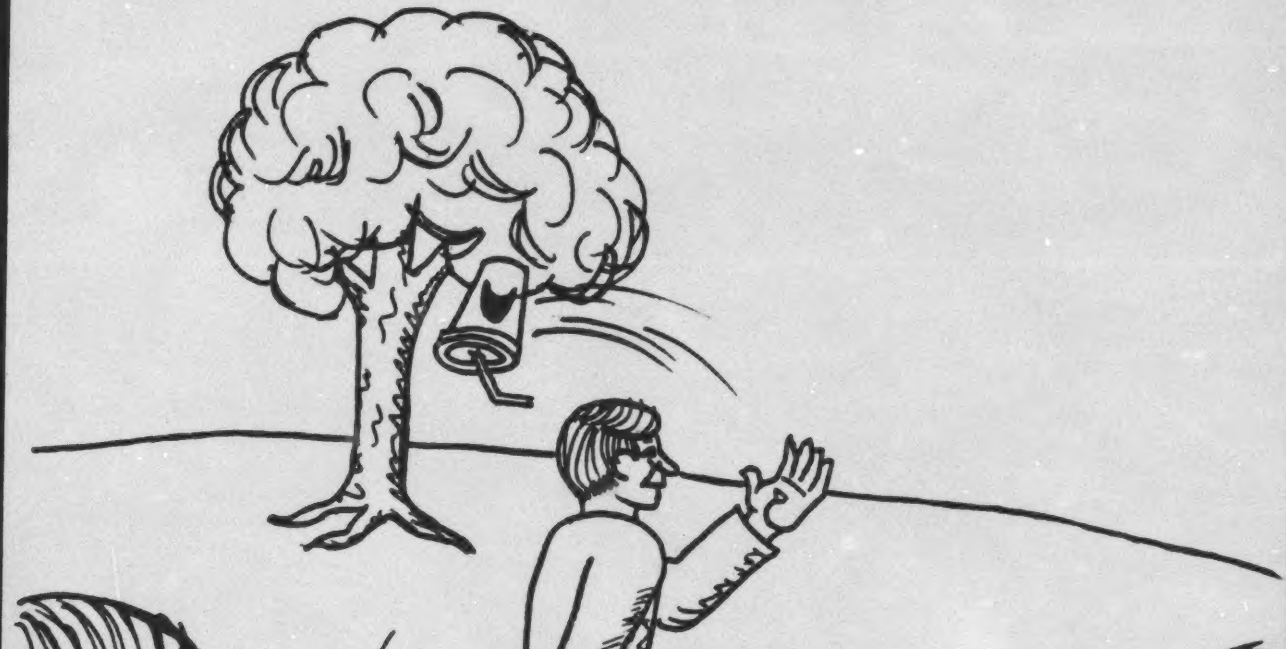








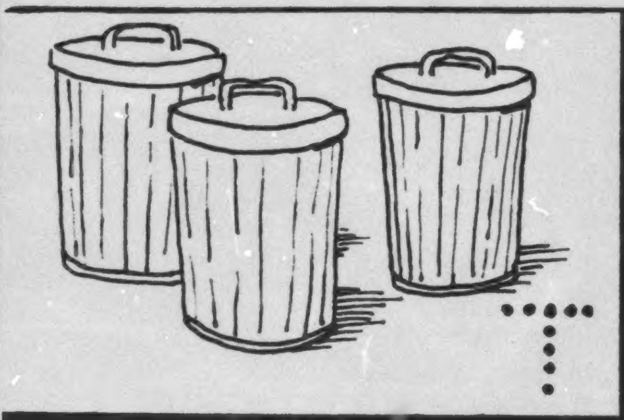
What would you do?

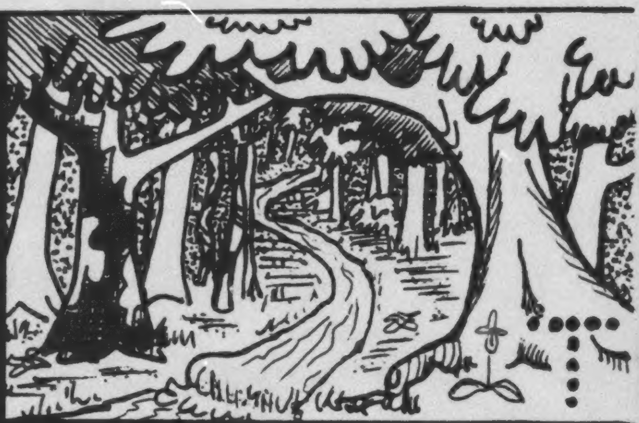


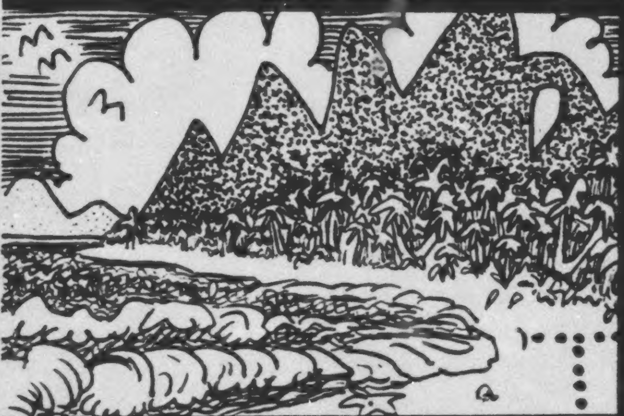
WHERE SHOULD TRASH GO ?

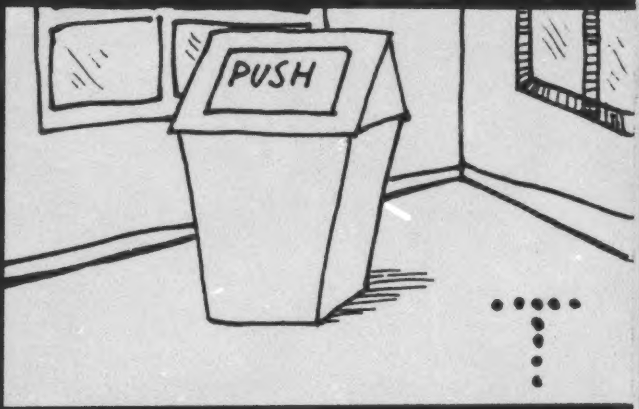
1 - II - 10

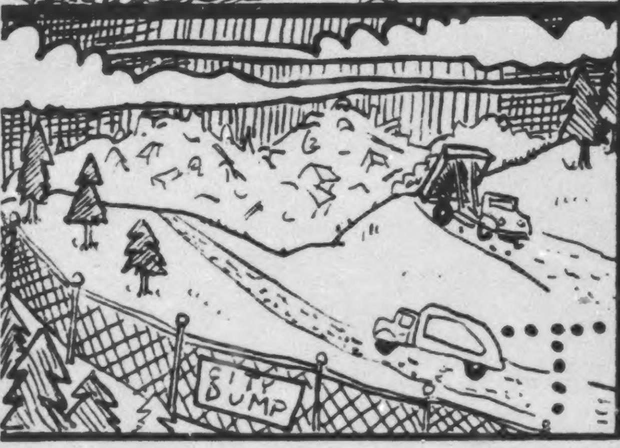
Complete the T under the pictures that show where trash should go.

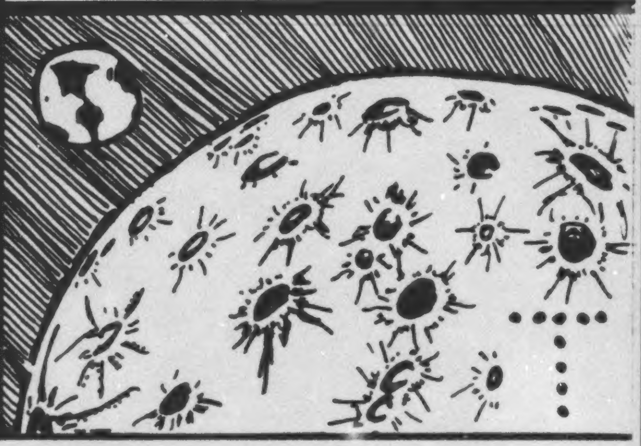












In the trash disposal scenario some events precede others. This activity asks the students to place the sketches in the correct time sequence. *1-II-6.*

Some of the geometric shapes which 1st graders should learn to recognize are reviewed. The "vehicle" is the ever present trash. *1-II-7.*

A teacher-led activity using the flannel board or substitute to provide a story of the sequence of events from trash makers to the landfill. *1-II-8.*

A teacher-led discussion about childrens' feelings concerning littering. *1-II-9.*

This final activity emphasizes the places where trash should and should not go. *1-II-10.*

SOLID WASTE/ENERGY CURRICULUM

GRADE 2

RECYCLING NATURALLY

LAND OF
RESOURCES
WELCOME TO RECYCSVILLE
$

UNIT I - RECYCLING LEAVES

The Strategy of Instruction

A study of the natural recycling of the leaves of forest, garden, street and lawns is used as a model to introduce the concept of planned leaf recycling by composting.

The recycling of tree leaves is related to the calendar and also to a sketch to relate the cycle of the seasons with waste recycling.

The Action

It is suggested that the teacher use the sketches and activity pages from this unit to develop the ideas of natural recycling of leaves and later of composting.

The information about both topics is presented in serial order with notations for children's activities. Each of the following sentences represents the big ideas for each activity page. You will probably want to have several class discussions to clarify the big ideas.

Children's Worksheets

Plants grow from soil, water and air. This activity introduces the children to different words associated with plant growth. *See activity 2-I-1.*

Grass clippings and tree leaves are parts of plants many people throw away. *Two activities. See activity 2-I-2.*

Tree leaves rot in the woods and gardens. They become part of the soil and air again. This activity introduces the children to the idea of natural recycling. *See activity 2-I-3.*

Tree leaves are different colors depending on the season. This activity may be used to demonstrate the cycle of the seasons. *See activity 2-I-4. Two activities.*

Recycling means to take apart and use over again. The recycling of air and water in the growth and rotting of tree leaves is introduced. *See activity 2-I-5.*

It takes many months or even years for the tree leaves to become part of the soil and air again. Leaf recycling takes time. The children could be in the fifth grade before some leaves are finished being recycled. This activity attempts to reinforce this idea. *See activity 2-I-6.*

When leaves are recycled by themselves in the woods, we say that the recycling takes place (naturally) in nature. *See activity 2-I-7. Activity 2-I-8 can be used to give the children a first hand look at rotting leaves.*

You can not watch the rotting and recycling of leaves happen. It takes place too slowly. Sometimes you may find a partly recycled leaf; it is called a leaf skeleton. *See activity 2-I-8.*

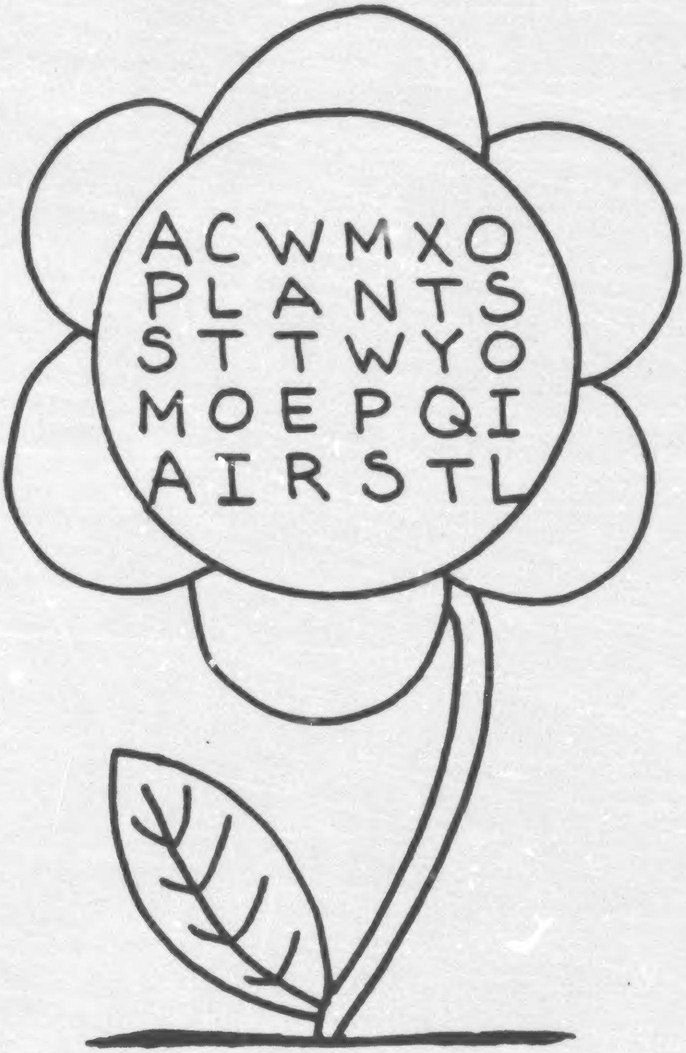
People who do not have lawns and gardens often throw the leaves away in trashbags. Sometimes the leaves are taken away by the city trash truck. This activity shows the children the most common, but wasteful, method of lawn waste disposal. *See activity 2-I-9.*

Some people help tree leaves and grass clippings to be recycled. They put leaves and clippings in a hole or pile. This activity introduces the idea of composting. *See activity 2-I-10.*

People recycle leaves and grass clippings by making compost piles. The rotting leaves and grass clippings being recycled are called compost. This is a lesson in number counting. *See activity 2-I-11.*

The children are given an opportunity to alphabetize and find dictionary meanings for new words related to composting and leaf recycling. *See activity 2-I-12.*

PLANTS GROW FROM SOIL, WATER AND AIR.

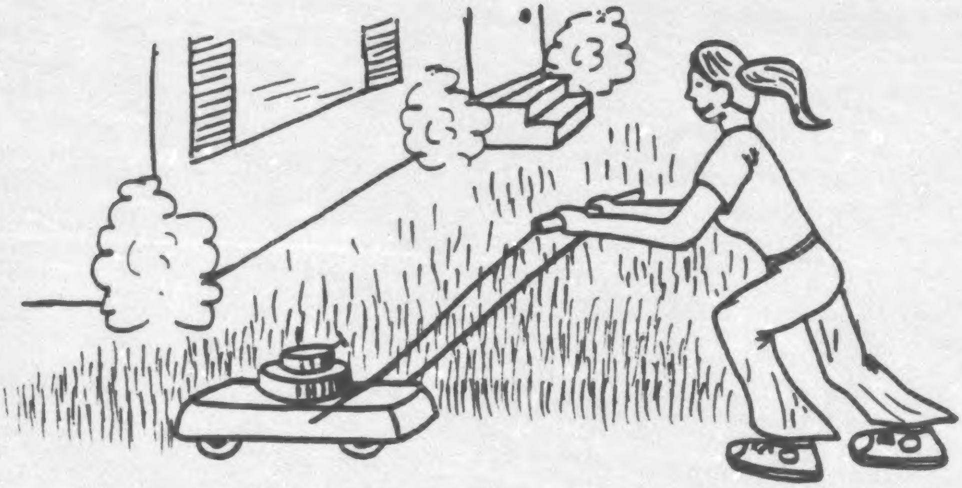


A C W M X O
P L A N T S
S T T W Y O
M O E P Q I
A I R S T L

PLANTS grow from SOIL, WATER and AIR.

Circle the words PLANTS, SOIL, WATER, and AIR in the flower puzzle above. You may also color the flower after circling the words.

Read the story. Answer the questions that follow the story.



Every Saturday Mary cuts the green grass on her lawn. She rakes up the grass cuttings, puts them in a bag, and sets them on the curb. On Monday the trash truck comes and takes the bags away.

Does Mary cut the grass on Saturday?

Is the grass brown?

Does Mary rake up the grass?

Does the trash truck come on Sunday?

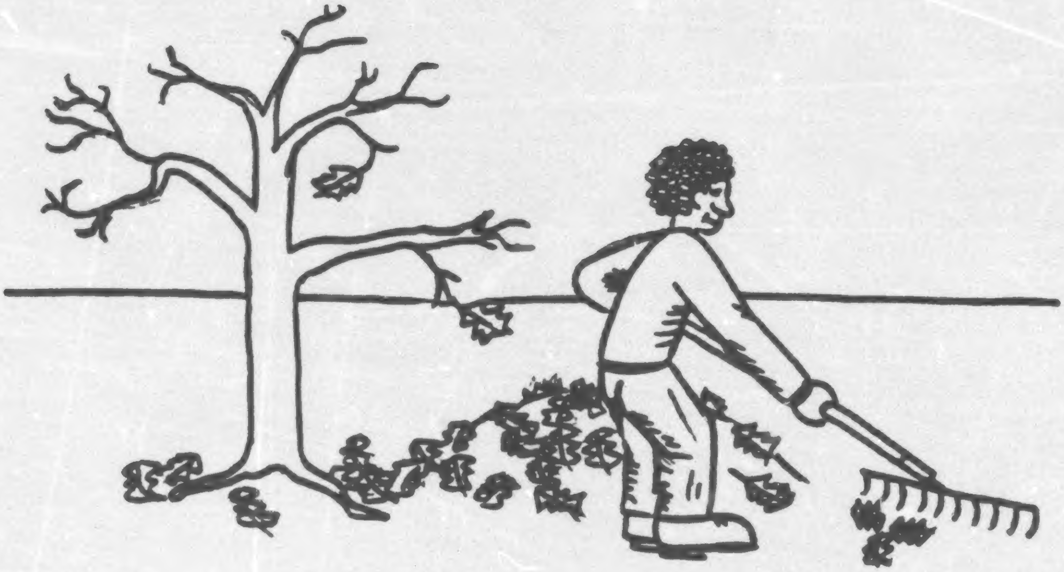
Does the grass grow in Mary's house?

Was the grass living?

Could Mary have saved the grass cuttings?

What could Mary have made with the grass cuttings?

Read the story. Answer the questions that follow the story.



In the fall, all of John's trees lose their leaves. He rakes the leaves into big piles and puts them into bags. He sets the bags out on the curb. The trash truck comes and takes them away.

Do the leaves fall off the trees in summer?

Does John rake the leaves?

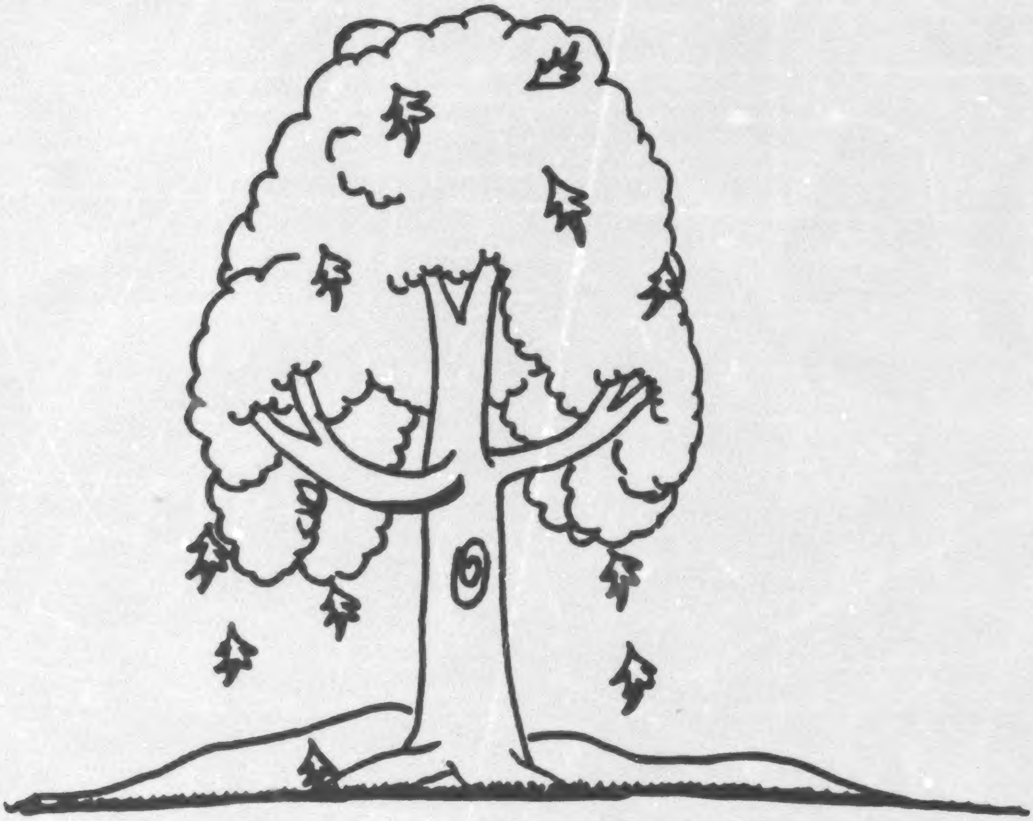
Does the trash truck take away the trees?

Were the leaves part of the tree?

Were the leaves living?

What do you think will happen to the leaves?

Read the story of the tree. Color the picture.



The tree is growing. It grows because it is getting lots of air along with water and plant food from the soil.

In autumn the leaves fall off the trees. That is why we sometimes call the autumn season fall. The leaves cover the ground. They will stay there and rot. They will become part of the soil. It will take a long time. One day parts of the leaves in the soil will go back to being part of the air.

The leaves grow, they fall, they rot, they become part of the soil again and then part of the air again.

LEAFING THROUGH THE SEASONS

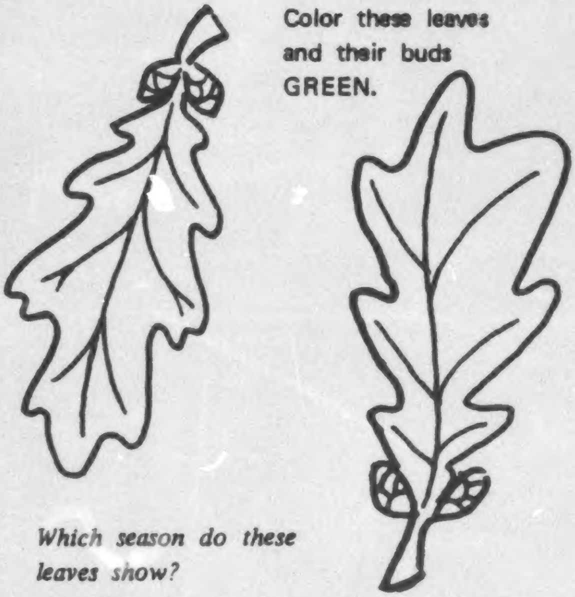
2 - 1 - 4

Leaves change color with each season. Color the leaves below.

Tell the season by the color of the leaves.

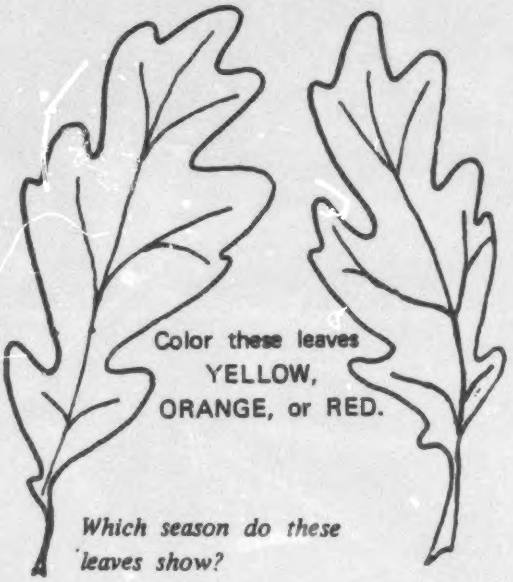
(Teacher's directions on back)

Color these leaves and their buds GREEN.



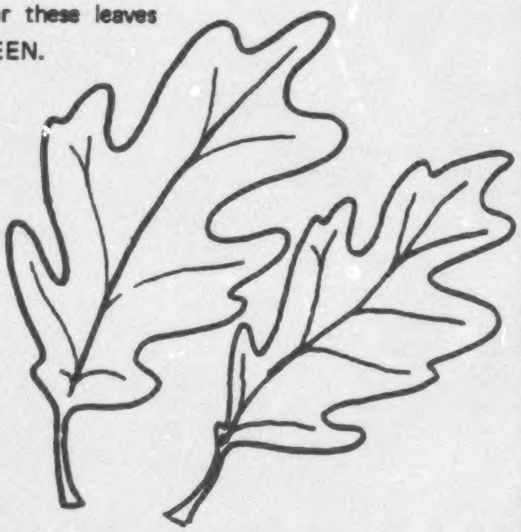
Which season do these leaves show?

Color these leaves YELLOW, ORANGE, or RED.



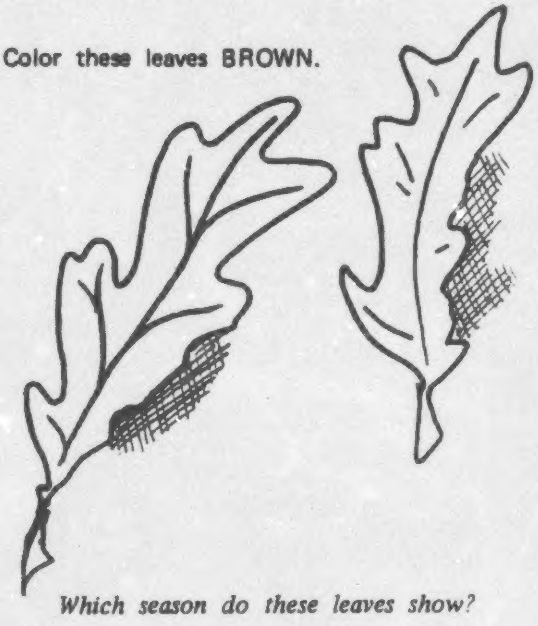
Which season do these leaves show?

Color these leaves GREEN.



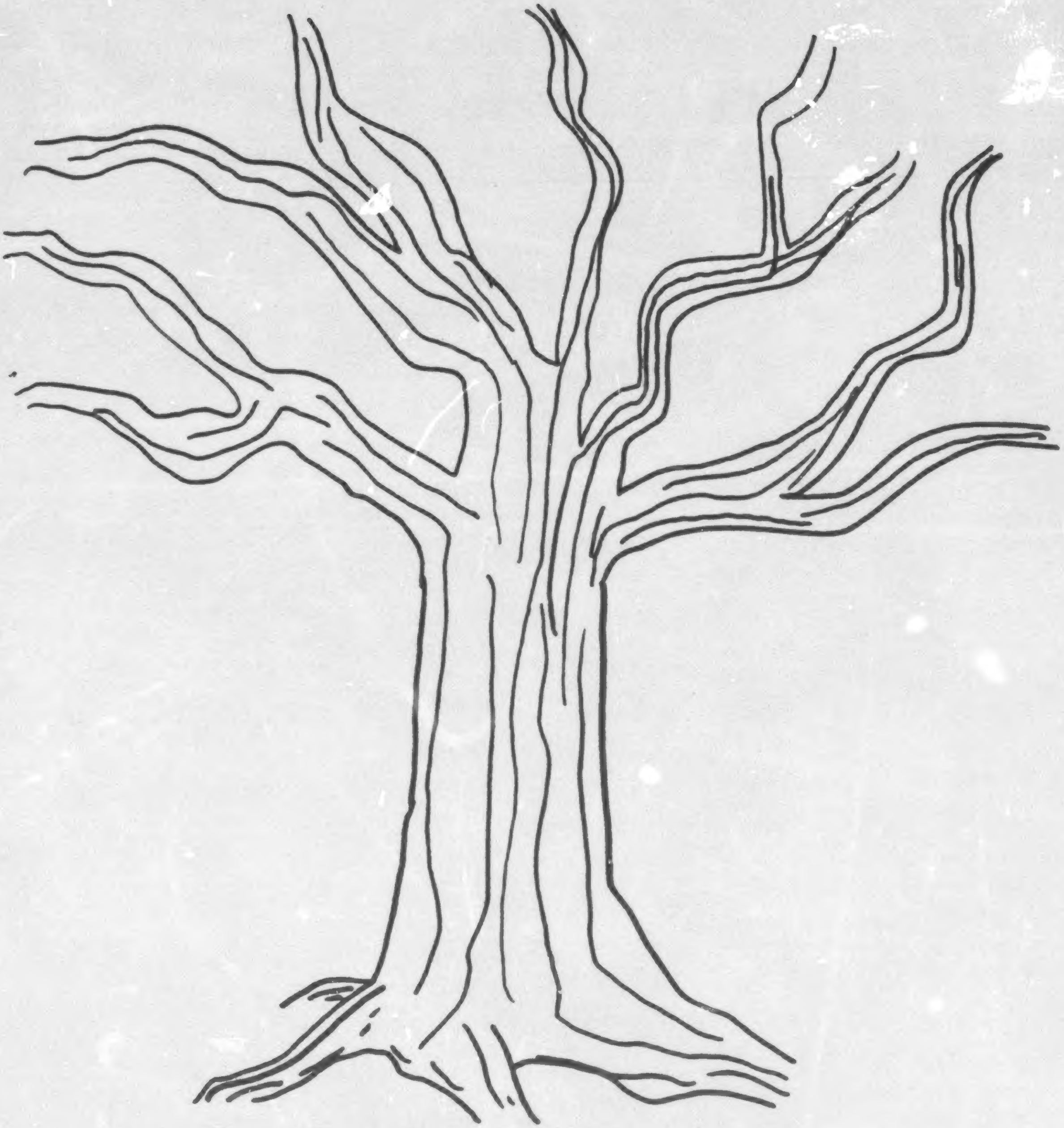
Which season do these leaves show?

Color these leaves BROWN.



Which season do these leaves show?

COLOR THIS TREE BROWN.



Teacher's Note: This activity may be used to demonstrate the cycle of the seasons. Divide a section of the bulletin board into four sections marking them spring, summer, fall, and winter. Have each child cut out and fasten his/her tree in one of the four season sections as you direct. The group of trees in each section represents a forest or wooded area. As you review the color and shape of the leaves appropriate for each season ask different children to cut out and attach one or more of their leaves on the trees in the proper seasonal section.

Follow the Leaf Through the Seasons

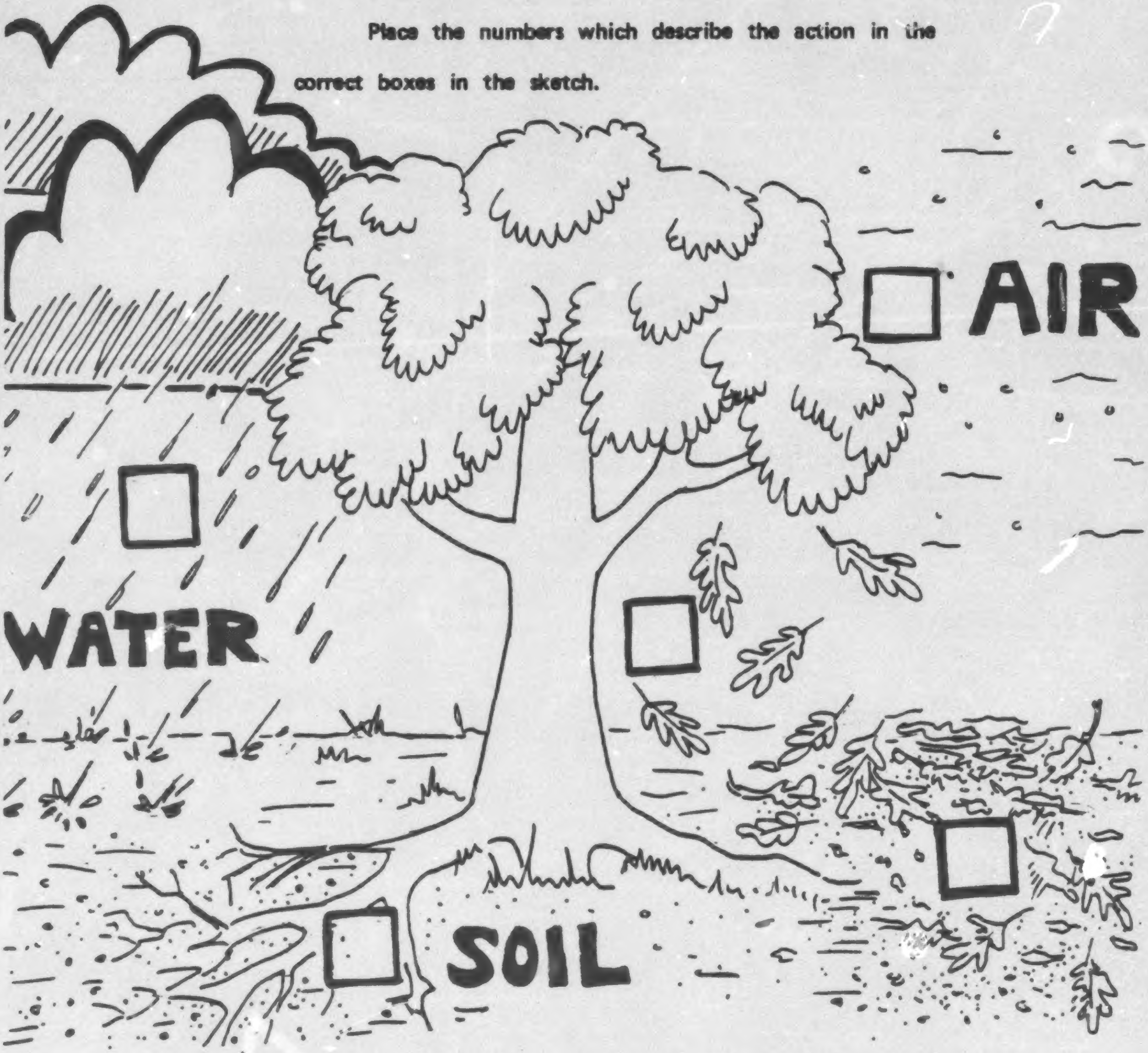
Discuss:

1. *In the spring new leaves are unfolding, but what happened to the leaf that fell off the tree in the fall?*
2. *What happens to the leaves in winter?*
3. *Why aren't leaves piled up over our heads in the forest?*
4. *What happened to all the leaves?*

THE RECYCLING OF LEAVES

This sketch shows the recycling of tree leaves from soil, water, and air back to leaves and back to the same elements.

Place the numbers which describe the action in the correct boxes in the sketch.



THE ACTION IN THE SKETCH

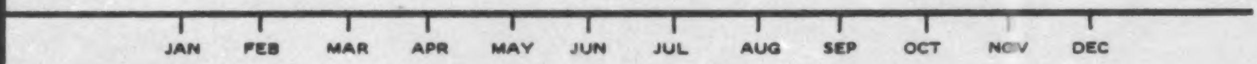
1. Rain water from the clouds enters the soil. It now becomes soil water.
2. Soil water enters the tree and its leaves through the roots in the soil.
3. Air enters the tree through its living leaves.
4. Leaves fall from the tree in autumn.
5. Tree leaves on the ground rot away. They change back into water and air.

RECYCLING TIME LINE

2-1-6

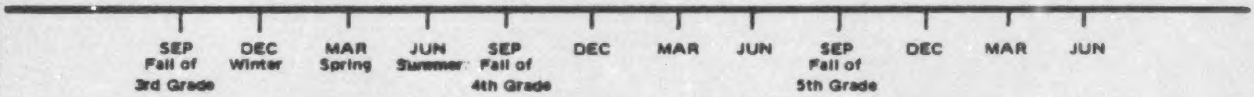
When leaves are RECYCLED or changed back to air and soil it takes a long time. You may be in the 5th grade before some leaves are finished being recycled. Look at the two TIME LINES below and answer the questions that follow.

Time Line For One Year


JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

1. In what month were you born? ________________
2. How many months is that away from January? _____
3. In what month does school end? ________
4. In what month does school begin? ________________
5. How many months between the beginning of school and the end? _____
6. How many months in a year? _____

Time Line From Beginning of 3rd Grade to The End of 5th Grade


SEP Fall of 3rd Grade
DEC Winter
MAR Spring
JUN Summer
SEP Fall of 4th Grade
DEC
MAR
JUN
SEP Fall of 5th Grade
DEC
MAR
JUN

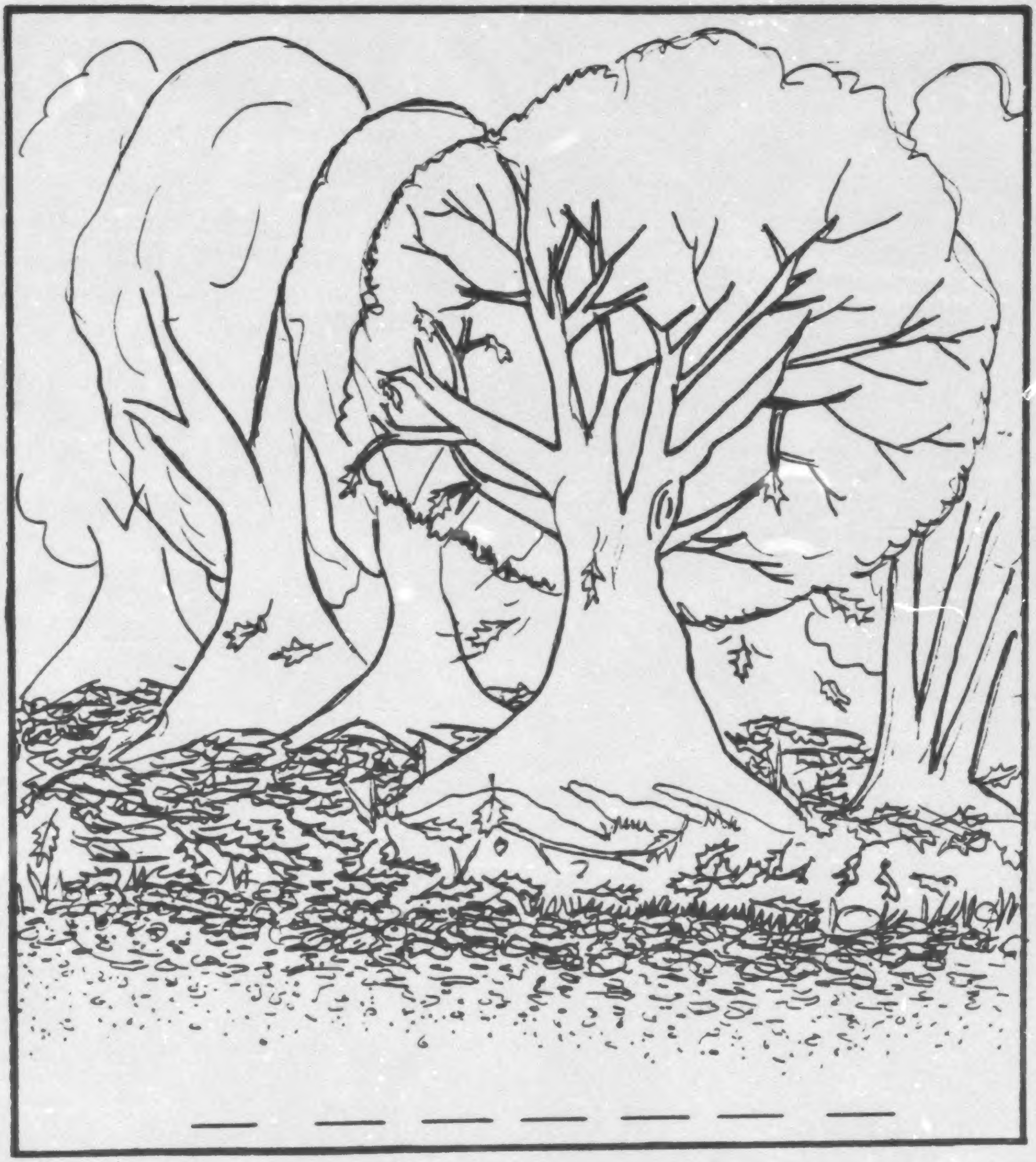
1. How old will you be in September (fall) of 3rd grade? ____
2. How old will you be in September (fall) of 4th grade? ____
3. How old will you be in June (summer) of 5th grade? ____
4. How many seasons are in one year? ____
5. How many years are shown on the time line? ____
6. How many months are in one year? ____
7. How many months are in three years? _____
8. How many months are between September and December? ____
9. How many months are between December and June? ____
10. How many months are between June and September? ____

Recycling Takes A Long Time!

Read the following story and look at the picture.

Here are trees in the woods. No one comes to rake the leaves. They stay on the ground and decompose (rot). After a long time the leaves will be recycled back into the soil and then into the air. The leaves will be recycled by nature. They will recycle naturally. Some leaves are being recycled all the time.

Write the word RECYCLE on the blanks at the bottom of the page. Draw arrows from the word RECYCLE on the blanks to places in the picture where leaves are being recycled. You may now color the picture.



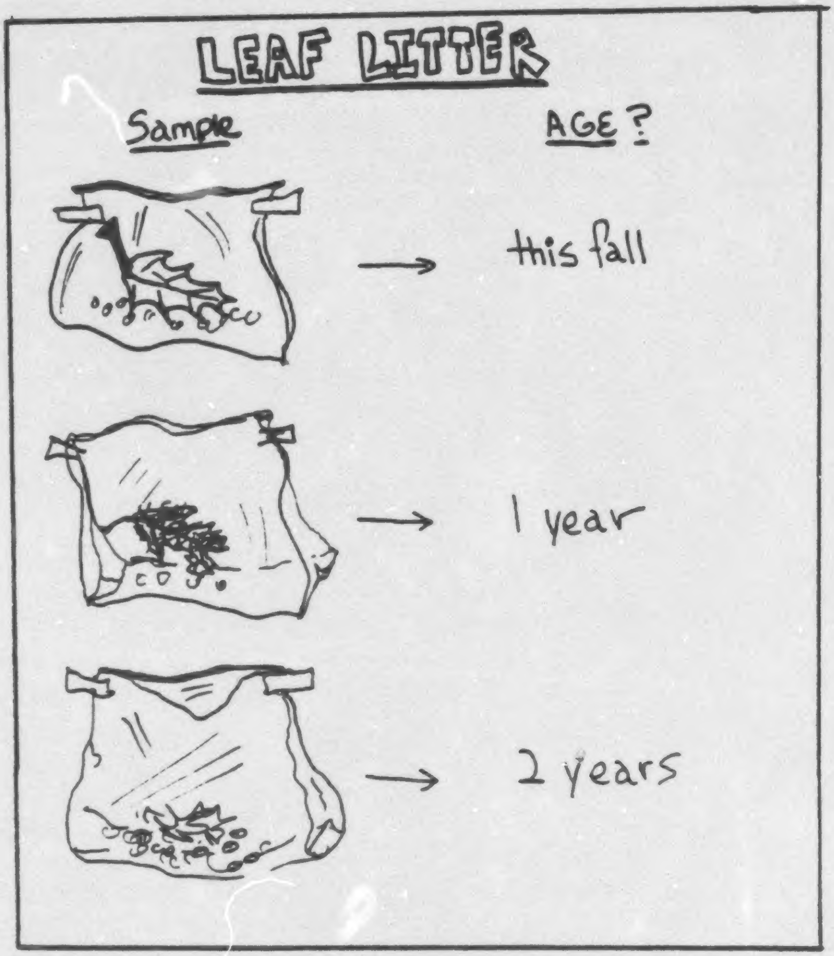
___ ___ ___ ___ ___ ___ ___

As a class, go out and visit a near-by woods. Dig down into the forest floor. You should notice different layers of rotting leaves. Take a sample of leaves from the top layer. Dig down two inches and collect another sample. Continue doing this until you reach the dirt floor.

Use a magnifier to study the leaves from each layer. Discuss as a class what is happening to the leaves as you go down deeper.

1. Put the leaf samples into separate sandwich bags.
2. Make a chart out of poster board to show your leaf samples.
3. Describe the leaf litter at each level and guess its age.

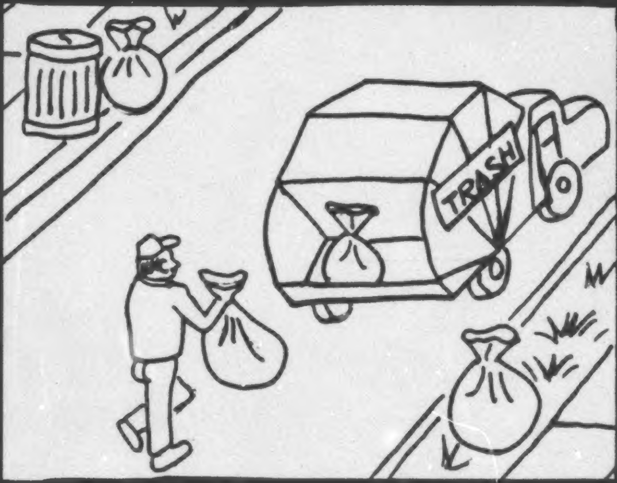
SAMPLE "LEAF LITTER" CHART

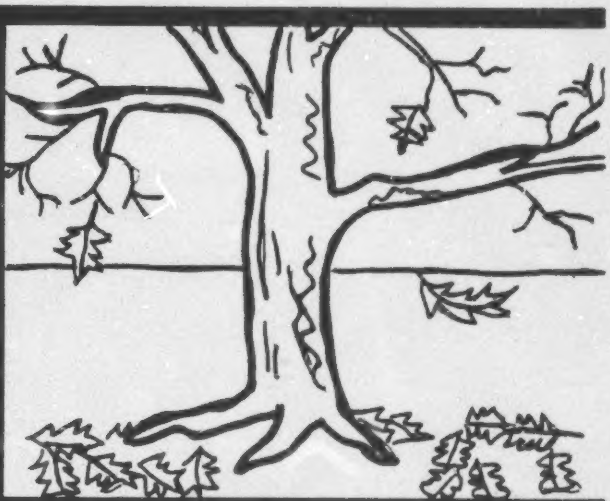


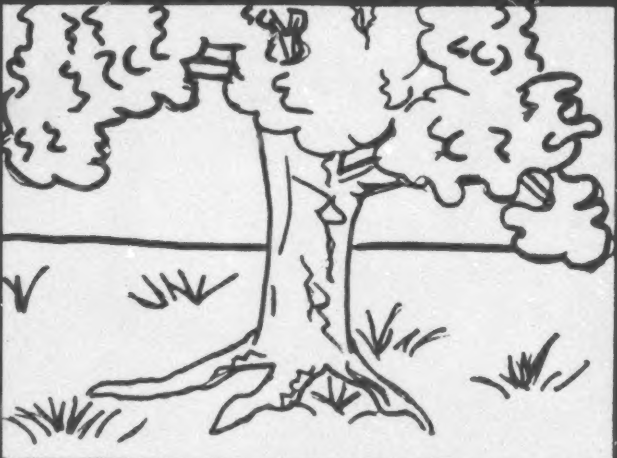
WASTEFUL WAYS

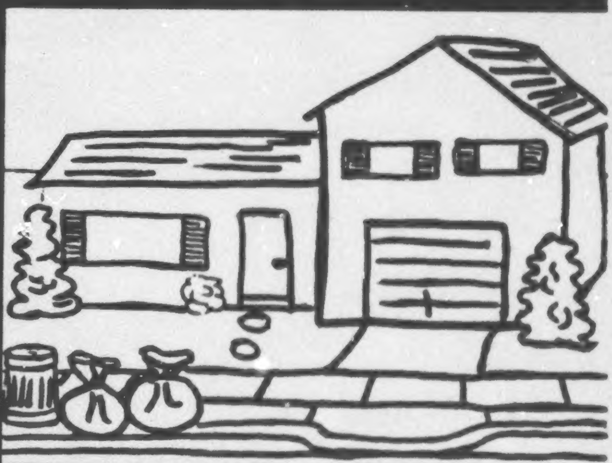
2-1-9

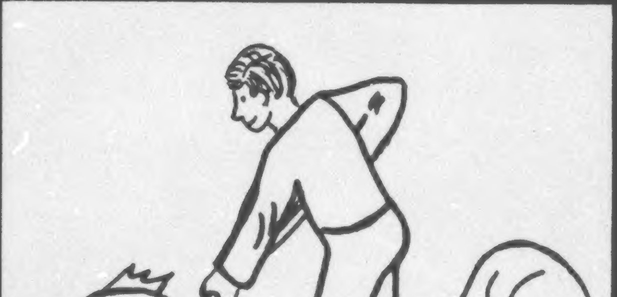
Some things have to happen before others can happen. Color the pictures and cut them out. Now arrange them in the proper order of how they happened - one after another.

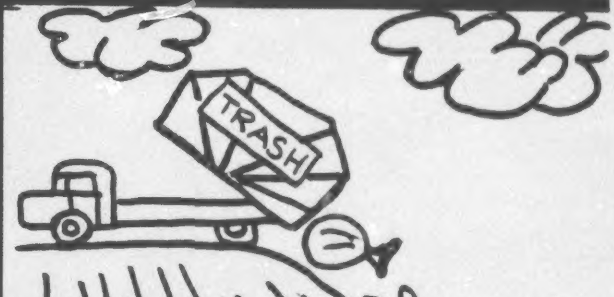












WHAT'S IN A COMPOST PILE?

2-1-10

Read the following story. After you read the story fill in the blanks on the activity sheet with the words found in the box below.

COMPOST

Sometimes people help to recycle leaves and grass cuttings. They do this by collecting them and putting them in a hole or a pile. This is called a compost pile.

As the leaves and grass decompose (rot) they are making good soil. Many people use this soil for their gardens. This is doing something good and useful with the parts of a plant many people throw away.

It is good to help the leaves recycle in a compost pile. It will take a long time, but your garden will love it.

1. People can help ______________ leaves by composting.

2. People help leaves turn into soil by having a ______________ pile.

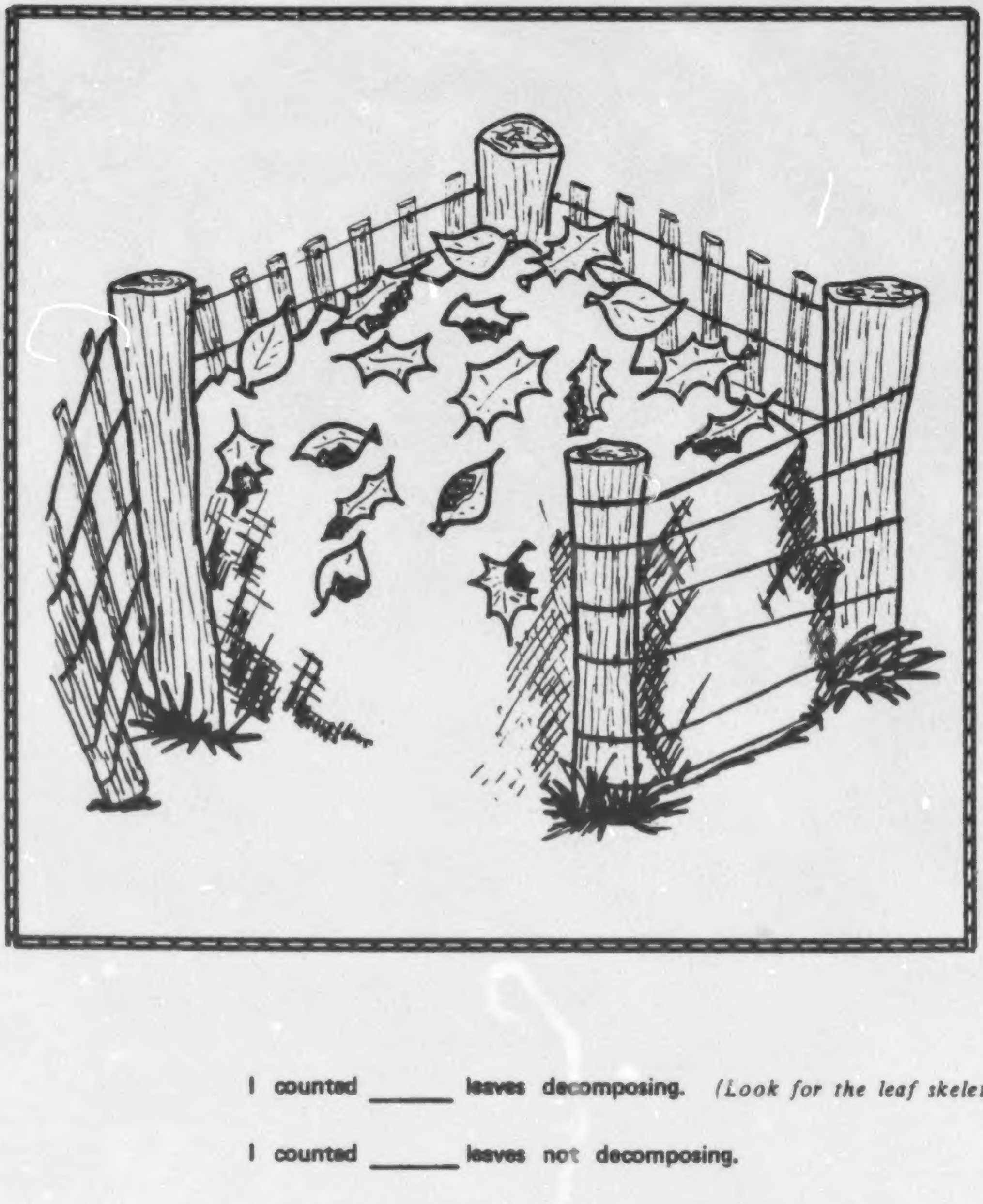
3. A compost pile is making good ______________ .

4. You can use the soil for your ______________ .

5. As leaves and grass cuttings ______________ (rot) they are making soil.

compost recycle soil garden decompose

Count the number of leaves that are decomposing in the compost pile. Count the number of leaves that haven't started to decompose. Count all the leaves in the compost pile.



I counted ______ leaves decomposing. *(Look for the leaf skeletons)*

I counted ______ leaves not decomposing.

I counted ______ leaves in the compost pile.

ALPHABETIZE YOUR NEW WORDS

Put the following new words in alphabetical order. You may also want to look them up in a dictionary to make sure you know what they all mean.

decompose
compost
natural
garden
water
rot
air

seasons
recycle
plants
living
cycles
soil

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

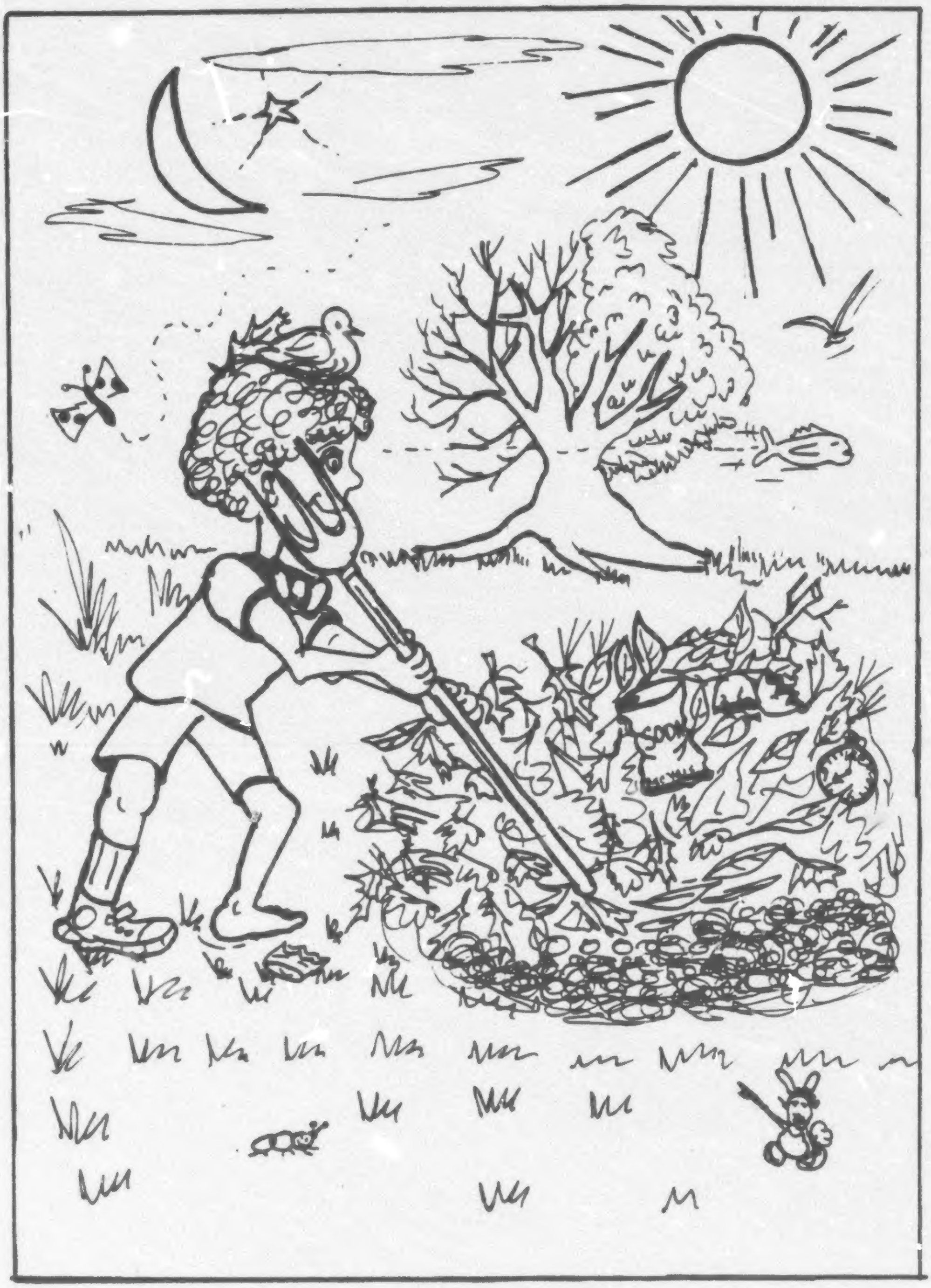
11.

12.

13.

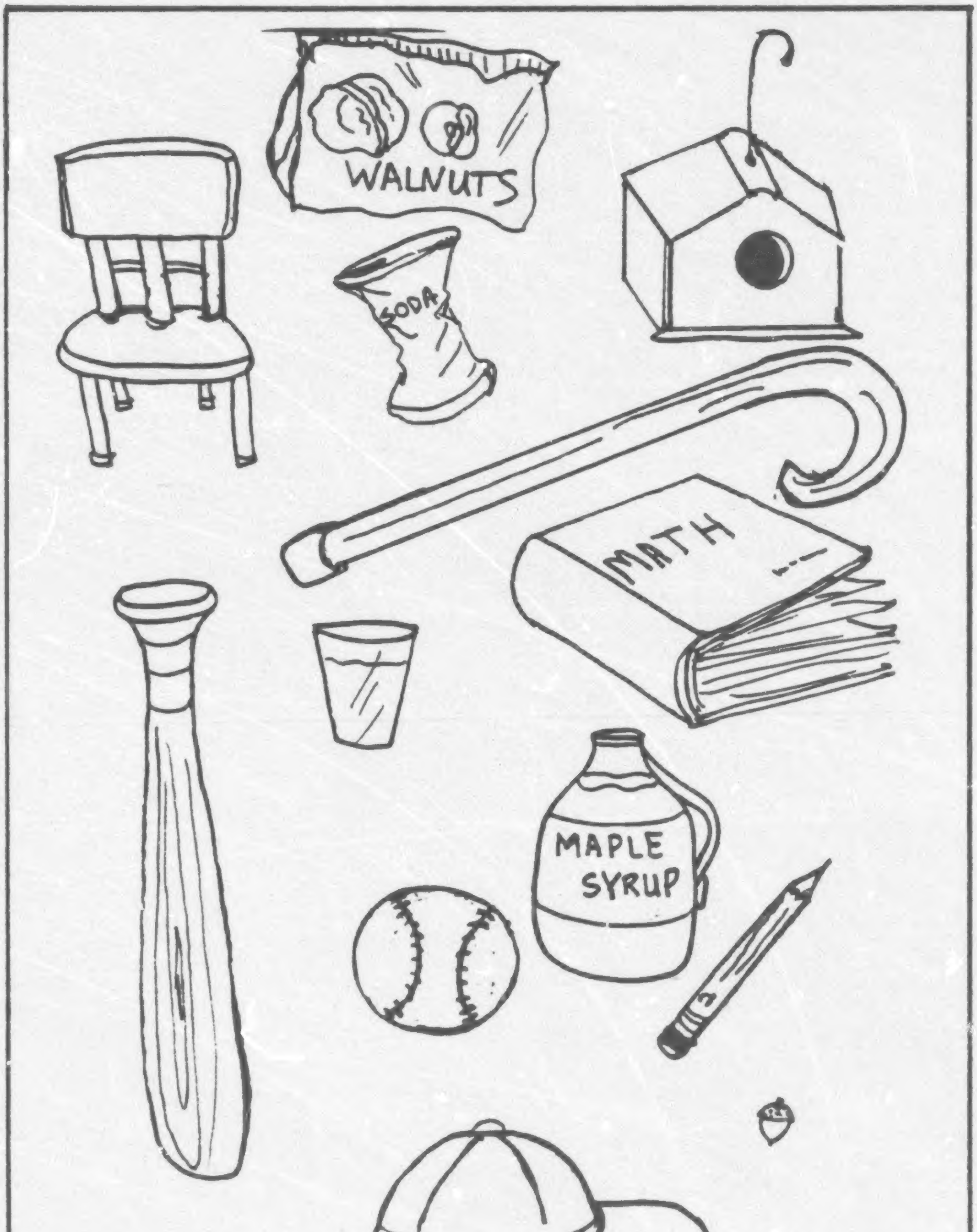
WHAT'S WRONG ?

This child is making a compost pile. Color the picture.
Put an 'X' through everything that is wrong in the picture.



MANY USEFUL THINGS COME FROM TREES

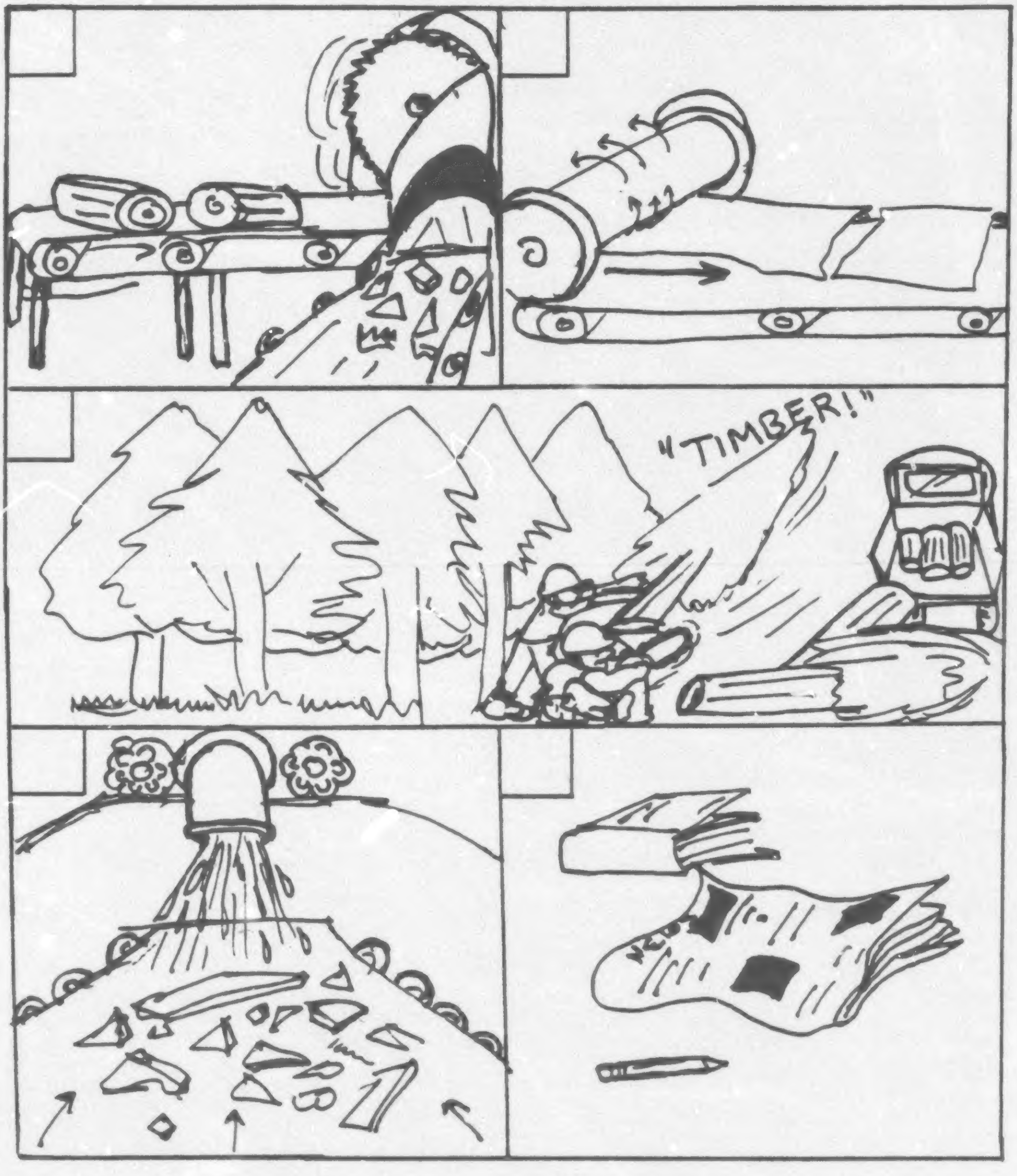
Paper is just one product that comes from trees. Below are many items. Color only the ones that are made from a tree.


WALNUTS
SODA
MATH
MAPLE SYRUP
3

Read the following sentences.

First, the trees are cut down in the forest. Second, the trees are chopped into tiny bits. Third, the bits of wood are mixed with water. Fourth, the mixture is squeezed into thin sheets of paper. Fifth, the paper is used to make newspapers and other kinds of paper products.

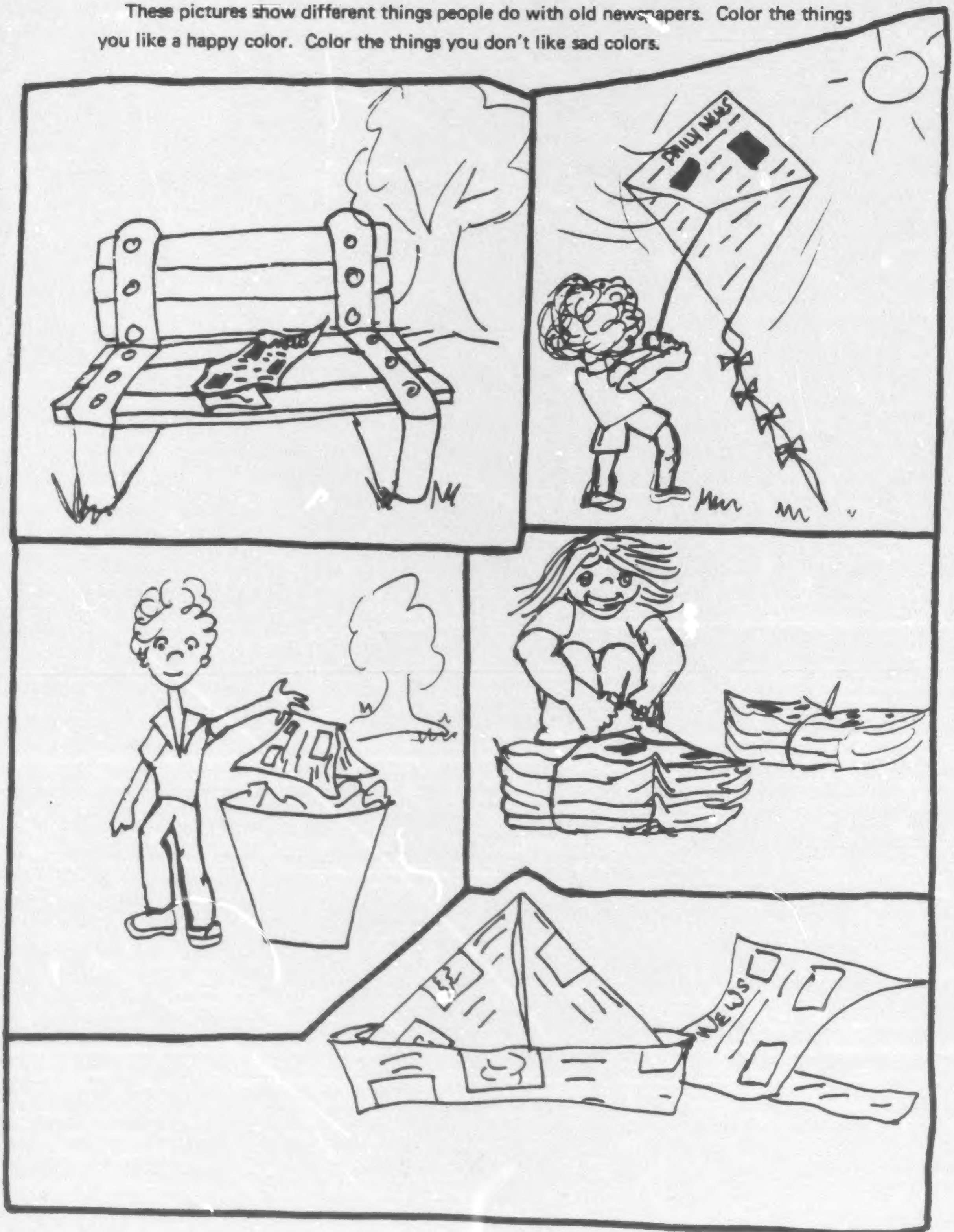
Now, put the pictures in order of now they happen by numbering the (☐) blocks in each sketch either 1,2,3,4, or 5.



SAD OR HAPPY

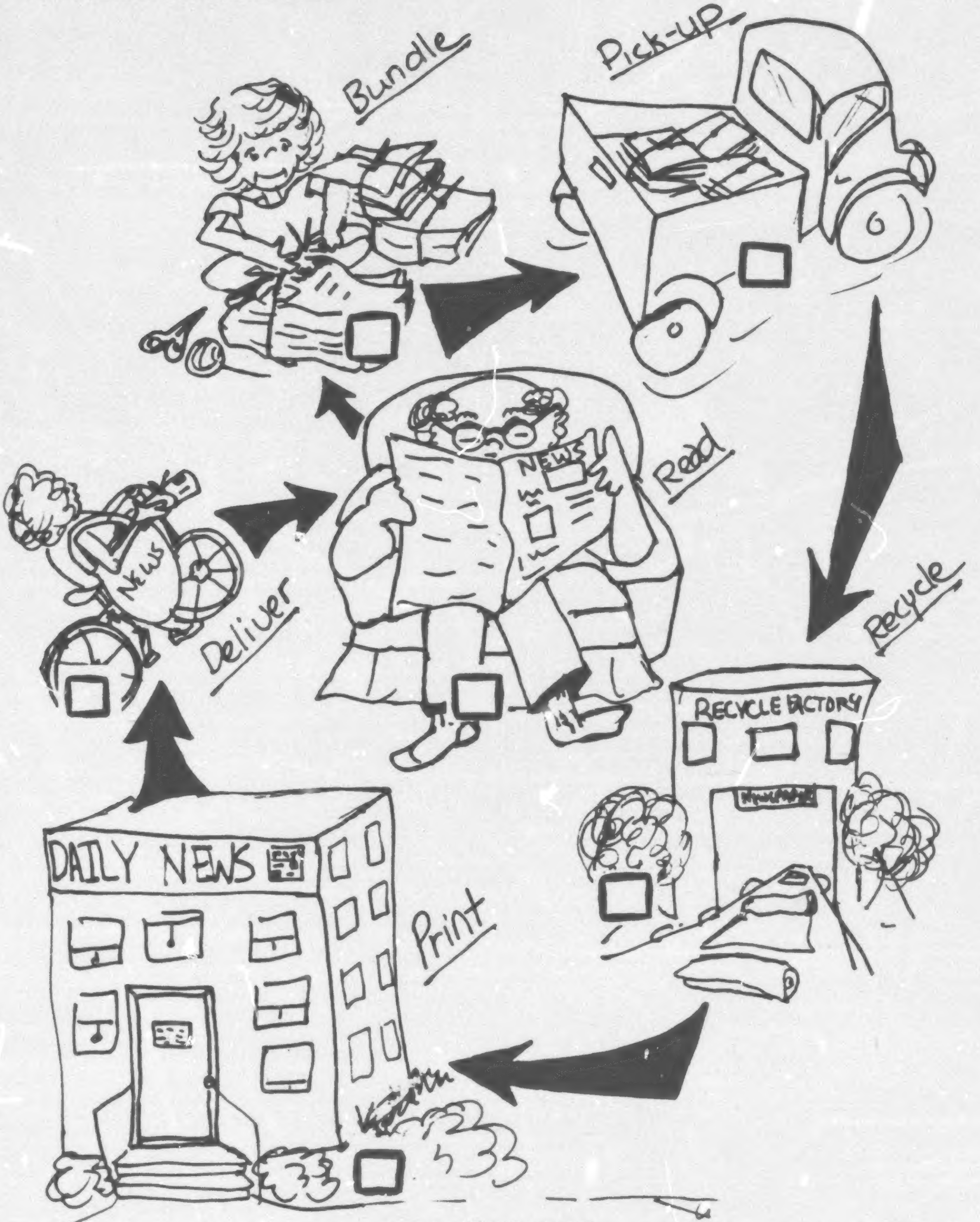
2 - II - 3

These pictures show different things people do with old newspapers. Color the things you like a happy color. Color the things you don't like sad colors.



TO THE RECYCLING FACTORY

2 - II - 4


Bundle
Pick-up
NEWS
Read
NEWS
Deliver
Recycle
RECYCLE FACTORY
DAILY NEWS
Print

FILL IN THE BLOCK

Write the number of the sentence in the correct box which tells the story of each picture.

1 Newspapers are printed in the news building.

2 Delivery boys and girls take papers to people's houses.

3 People usually sit down to read the newspaper.

4 Newspapers must be bundled to be taken away.

5 Trucks take away bundled newspapers for recycling.

6 At the recycling center, usable clean paper is made from the old paper.

USING NEW WORDS

Use each word in a sentence to tell about newspaper recycling.

newspaper
save
recycle

collect
factory
home

1.

2.

3.

4.

5.

6.

RECYCLING CALENDAR

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY

Teacher's Directions: Have the students find out whether or not a newspaper collector visits their neighborhood. On which day does the collector come? On the "Recycling Calendar" have the students draw a picture to remind them on which days the paper collector comes.

Also, find out on which days the trash collector comes. Draw a picture on those days.

Maybe there is a day when an aluminum collector comes, or a garbage collector–draw pictures for those days too.

Helping to separate different trash items for collection could be a new job for the children at home.

POSTERS HELP TO SAVE TREES

2 - II - 7

Make a poster about recycling newspapers to save trees. Choose a title which will make people want to save trees by recycling.

People who have lawns and gardens may have compost piles. The children are to decide what is wrong in the picture. *See activity 2-I-13.*

UNIT II - RECYCLING PAPER

The Strategy of Instruction

This unit is designed to introduce the concept of paper recycling. Paper is selected because it is the most frequently recycled of trash items. It is also more readily related to living trees, natural resources or natural products of the earth. The activities also emphasize the separation of newspapers at home for recycling collection.

The Action

It is suggested that the teacher use the sketches and activity pages from this unit to develop ideas about the recycling of paper.

The information about both topics is presented in serial order with notations for children's activities. Each of the following sentences represents the big ideas for each activity page. You will probably want to have several class discussions to clarify the big ideas.

Children's Worksheets

Paper can be recycled too. Old used paper is made into new paper again. *See activity "Recycling by Man," 5th grade: C-3.*

Most kinds of paper like newspaper comes from trees. We get or use many other things from trees. *See activity 2-II-1.*

First the trees are chopped into tiny bits. Then the bits of wood are mixed with water and squeezed into a thin sheet of paper. *See activity 2-II-2.*

People use old paper differently. Some people throw old paper away. Some people burn old paper. Some people recycle paper. *See activity 2-II-3.*

Paper is recycled in a factory. The recycling factory needs paper from each person's home. *See activity 2-II-4.*

Paper from your house can be saved to send to the recycling factory. *See activity 2-II-5.*

Sometimes the recycling paper collector comes on a special day. You should know that day. *See activity 2-II-6.*

When we save paper for recycling, it helps to save trees. *See activity 2-II-7.*

CESC
CETA
2

SOLID WASTE/ENERGY CURRICULUM

TEACHER BRIEFS

For Teachers of Grades 3 and 4

INFORMATION JUST FOR YOU!

- -- *Why Teach About Solid Wastes?*
- -- *How To Use This Curriculum Special Features*
- -- *What About?*
  - *- The Big Ideas*
  - *- Evaluation*
  - *- Grade Level Placement*
  - *- Answers to Questions and Numerical Problems*
- -- *County Multi-municipal Source Separation Program*

CONSERVATION AND ENVIRONMENTAL STUDIES CENTER, INC.

120-13 Whitesbog Road

Browns Mills, New Jersey 08015

Produced by a grant from Burlington County CETA

2311 Burlington - Mt. Holly Road

Burlington, New Jersey 08016

INFORMATION JUST FOR YOU

WHY TEACH ABOUT SOLID WASTES?

The specter of hazardous wastes frightens every community. We are all having more and more trouble throwing things away. Each year there is actually more to put in the waste can; and each year there seems to be less space available for disposal. Surprising amounts of energy are spent or lost with our present means of getting rid of wastes. The disposal of solid wastes is the hottest environmental problem today.

Here are some reasons why you might want to share some learning experiences about trash and garbage with your kids.

Landfills are closing up; we're running out of landfill space.

Trash/garbage collection costs more and more, taking an increasingly larger tax bite.

Hazardous wastes are the focus of the latest scam by organized crime

Everybody comes in contact with solid wastes daily.

There are excellent opportunities for drills with basic skills:

mathematics - measurement, drill and data interpretation

group leadership and interaction

language arts - spelling, writing,reports, giving oral reports to peers and adults, letter writing, vocabulary and using library and other research techniques.

art - murals, posters, sketches, plays, skits, songs

values consideration - exploring the values of self and others

HOW TO USE THE CESC/CETA SOLID WASTE CURRICULUM SPECIAL FEATURES

You may be weary of seeing new curriculums and even when you like them, wonder how you could possibly add anything more. Here's the good news about this curriculum:

You may plagiarize. You may save paper and money by photocopying any or all activities as you please.

It's designed as a take-it-or-leave-it curriculum You may use as few as one lesson/activity or as many as you like. It's open ended.

It is multi-disciplinary, can be related to various studies; it's interdisciplinary in many activities; the subject matter boundaries are broken down.

You may conduct field trips at your own school or your community.

WHAT ABOUT ? ? ?

The Big Ideas

The prime learning objectives are prominently displayed as "The Big Ideas." If you would like your students to develop these generalizations on their own (by induction), you may block out the "Big Ideas" so that they won't appear in the photocopies.

Evaluation

One successful kind of evaluation is that in which the teachers are satisfied that objectives have been achieved. Each objective is keyed to one or more activities which should, if successfully carried out, provide evidence for the achievement of an objective. The many products of these activities, data pages, oral and written reports, drawings and murals are chief sources of evidence.

The section called "On Your Own" is not only intended to be a profitable set of follow up activities. These activities also lend themselves as an evaluation tool.

Answers To Questions and Numerical Problems

You will find answers for all questions on pages 3 or 4 of the unit folder which is your special unit teacher's guide.

Grade Level Placement/What Activities For What Grade Level?

If the activities included in any grade level cluster present a problem, you'll have to deal with it by agreement in any school or "district wide" as you choose. Certainly you will want to avoid the deadening effect of "we did this last year." You will probably want to divide the activities among or between the grades.

It seems best to leave the choice to you especially since with classes of younsters with varying abilities, interests, and curricular freedoms, you may even wish to utilize activities from a different grade level cluster.

SOURCE SEPARATION AND RECYCLNG

THE PROPOSED MULTI-MUNICIPAL SOURCE SEPARATION RECYCLING PROGRAM FOR BURLINGTON COUNTY

This information applies to:

Grades 3-4, B-2 "Recycling Relay Game," Grades 5-6 Unit C (all activities D-2 "What If We Source Separate?" Grades 7, 8, and 9 D-3 "What If We Recycle Steel, Aluminum, and Glass?"

The volume of municipal solid waste generated in New Jersey each day is of sufficient volume to fill Giants Stadium every two weeks.

As solid waste management problems have become increasingly evident, methods have been sought to mitigate the negative aspects of "garbage." Planners have sought to develop measures that would both lower the volumes of materials going to landfills as well as put that particular material to a subsequent use. Recycling of material such as newspapers, glass and metals performs both of these functions.

Under New Jersey Public Law 1975, Chapter 326, entitled the New Jersey Solid Waste Management Act, each county and the Hackensack Meadowlands Development Commission were designated as solid waste management districts. Under the Act, each district is responsible for developing and implementing plans which provide for the "maximum practicable use of resource strategies" (i.e. recycling).

The Burlington County Office of Waste Management Programs, situated within the County Health Department, has developed an implementation plan for a two-year pilot program in curbside collection of source separated newspaper. Source separation programs are a major component of the overall resource recovery strategy identified in the Burlington County District Solid Waste Management Plan recently adopted by the Board of Chosen Freeholders. The source separation plan sets forth a comprehensive program whereby a private contractor will provide curbside collection of used newspaper on a bi-weekly basis throughout the Townships of Cinnaminson, Delran, Moorestown, and Willingboro. The contractor will not be paid by the participating townships or the County for this service, but instead is expected to offset his capital and operating costs and receive a reasonable rate of return on his investment through revenues generated from the sale of the recovered newspapers.

Scout troops, charitable organizations, and individual scavengers will be able to continue their operations with only minor changes in their present collection methods. In fact, recent studies indicate that such groups thrive when coexisting with a formalized municipal program.

The proposed program is designed to be basically self-supporting (not requiring a subsidy through the use of tax-payers money) and will provide a savings to the individual townships. These savings can appear as 1) rebates from the newspaper collector based on tonnage of newspaper recovered. 2) Rebates from the mixed - refuse collection in townships with contracted garbage collection systems or in the case of townships with their own regular garbage collection systems direct cost savings are encountered through the decreased volume of waste physically collected by them. 3) Rebates from savings encountered by re-routing regular garbage collection vehicles in a more energy efficient manner by taking advantage of less regular waste found at each collection stop. 4) reduced disposal costs due to less material to be landfilled; and 5) conservation of scarce and costly landfill capacity. With each ton of newspaper recycled, three cubic yards of landfill space is conserved and seventeen trees from our valuable forest lands need not be cut down for their pulp value. In addition, 60% to 70% less energy is utilized in producing new pulp products from recycled paper, versus virgin wood pulp.

Oil is not the only imported material which is having an impact on the United States trade deficit and contributing to the current inflationary spiral. Numerous raw materials used in manufacturing processes are imported into the U.S. Many of these raw materials are presently in the municipal waste stream and could be recycled to produce and economically attractive domestic supply. New newsprint is one example. Implementation of newspaper source separation programs similar to the one proposed will help alleviate the U.S. dependence on imported newsprint. At the same time, this effort will also foster the strength and expansion of recycling industries which contribute significant primary manufacturing strength in the New Jersey economy through jobs and rateables. The proposed recycling program should afford the resident an opportunity to effectuate a change in historically wasteful and environmentally damaging solid waste management trends.

Present projections call for the initiation of the proposed source separation newspaper recycling program in April 1981.

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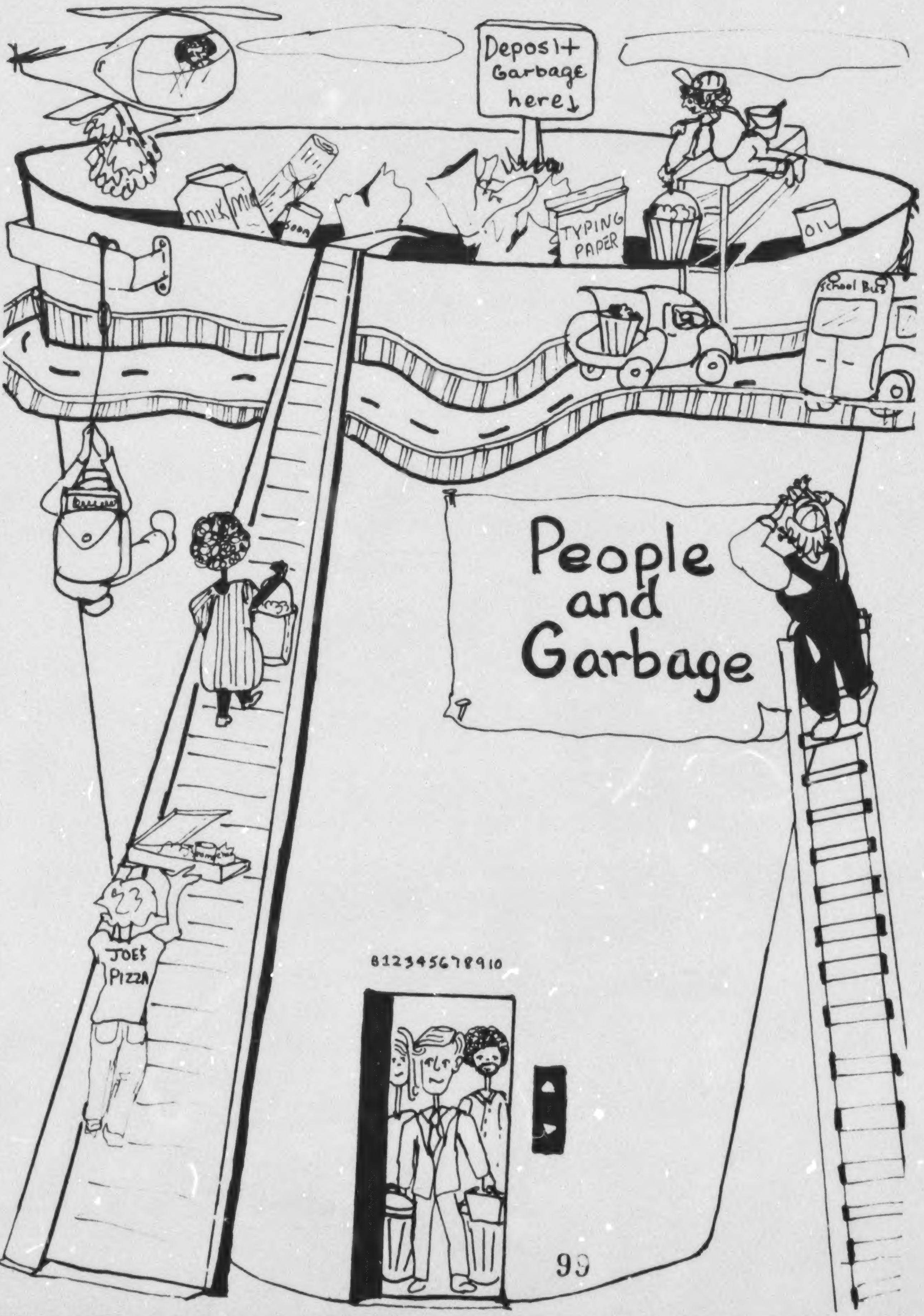
* Adopted from the descriptive text developed by Burlington County Office of Solid Waste Management Program.


Deposit Garbage here↓
MILK
SOAP
TYPING PAPER
OIL
School Bus
People and Garbage
JOE'S PIZZA
23

B12345678910

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING ACTIVITIES:

(Each of the Action Cards may be reproduced individually for the students to work on.)

A 1 WHAT'S GARBAGE?

PREPARATION: None

SKILLS: Reading comprehension, vocabulary, recording information, classification, and set theory.

Garbage is anything that people throw away. It is made up of a variety of materials. In this lesson the students will classify the composition of garbage by filling in a chart on their Action Cards.

Have the students read the Big Ideas on the Action Card. Initiate a class discussion on these ideas. Questions which are helpful in this discussion include:

— What garbage did you throw out today?
— What was it made of?
— What other materials do you throw out?
— Can you think of others? Make a list.

A 2 WHO MAKES GARBAGE?

SKILLS: Reading comprehension, vocabulary, sketching, organizing information.

PREPARATION: None

Although more than one half of all garbage comes from people's homes, large amounts also come from agricultural, industrial, institutional, and municipal sources. In this lesson the students will discover where garbage comes from and also what kinds of garbage comes from these sources by completing the Action Cards. After the students have read the Big Ideas, initiate a class discussion with the following questions:

— What garbage did you make today?
— What activity led you to make garbage?
— What other activities do you do that make garbage?
— Does everyone make the same garbage as you ? Why? If no, what kinds of garbage do other people make?
— What kinds of garbage come from farms? factories? gas stations? restaurants? hospitals?

A 3 WHERE DOES GARBAGE GO?

SKILLS: Reading comprehension, vocabulary, role playing, music, group cooperation, oral communication, values clarification.

PREPARATION: None

In most communities solid waste is collected once or twice each week by garbage men driving large trucks. Children at this grade level sometimes think that the garbage is taken "away." However, this place known as "away" does not exist. All garbage must go somewhere.

In this lesson the students are asked to read and/or act out a play. The play describes the adventures of Johnny Jones; a boy who takes a journey inside a garbage truck. Surrounded by animated pieces of garbage, Johnny is able to ask questions and learn about the many different methods of solid waste disposal. Johnny learns where the garbage goes.

ACTION CARD A2

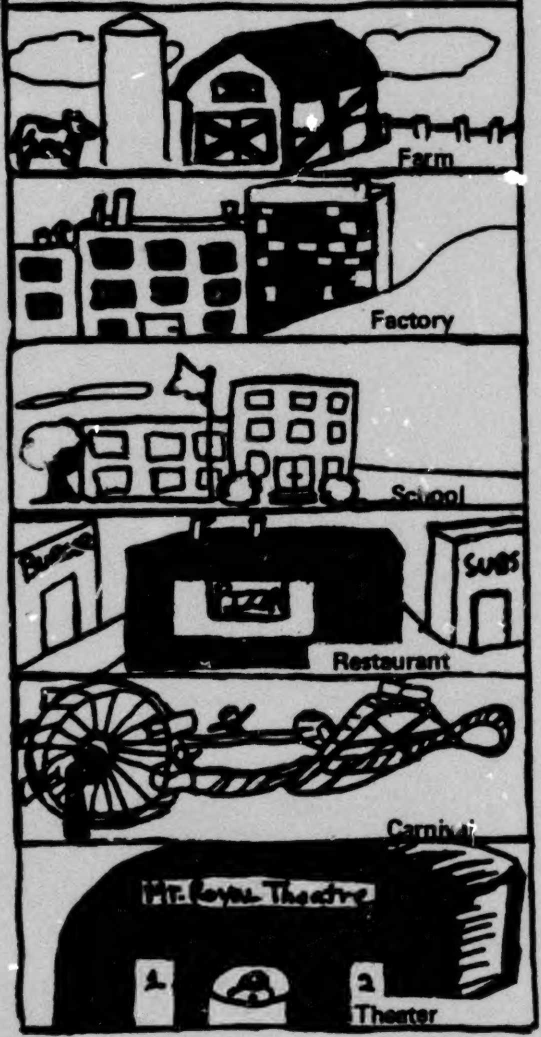
WHO MAKES GARBAGE?

BIG IDEAS:

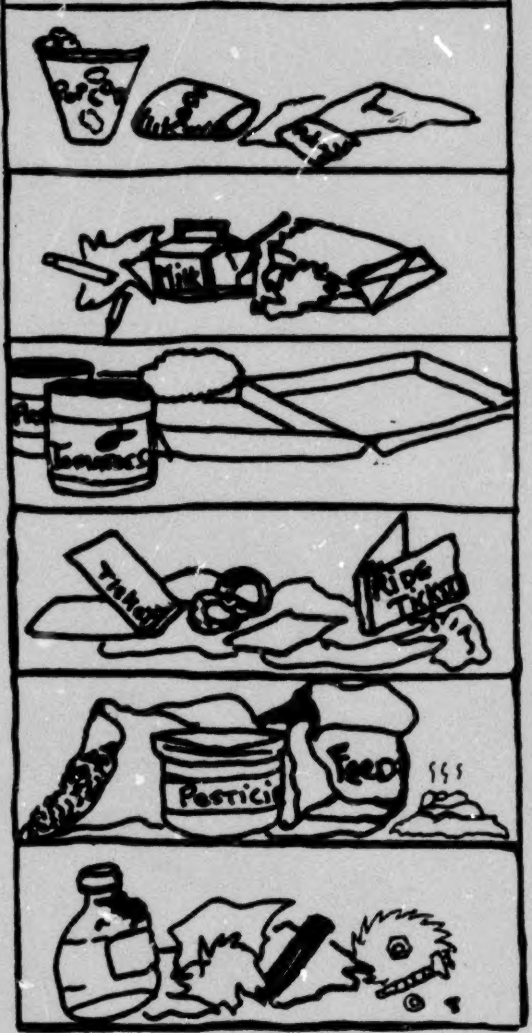
Garbage comes from many places. It comes from schools, factories, farms, houses and work places. Different places make different kinds of garbage.

DRAW LINES TO SHOW WHO MAKES WHAT GARBAGE.

WHERE IT COMES FROM

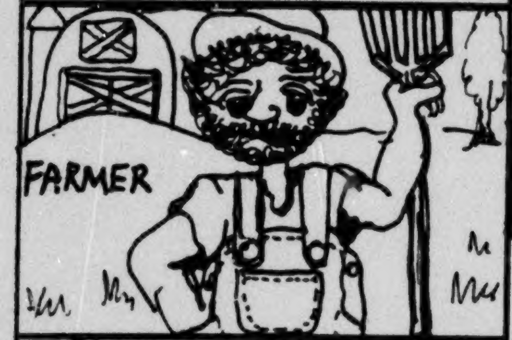
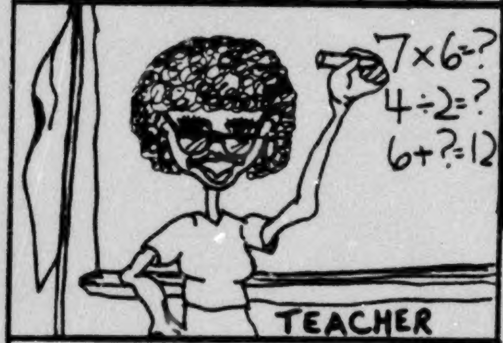
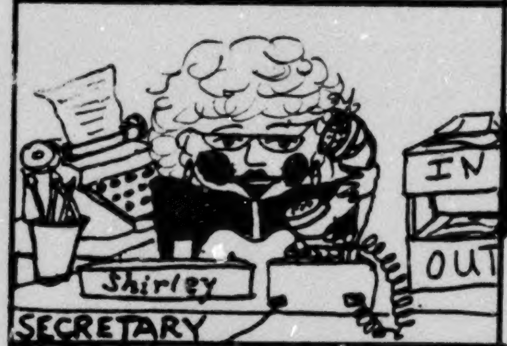
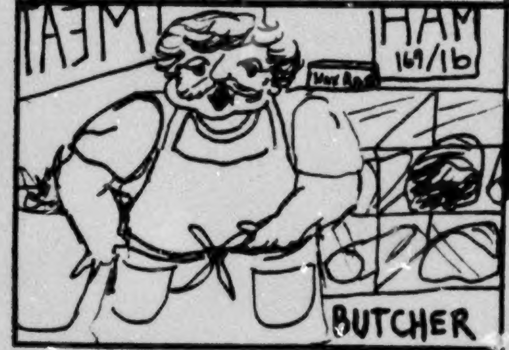

Farm
Factory
School
Burger
Pizza
Subs
Restaurant
Carnival
Mt. Royal Theatre
1
2
Theater

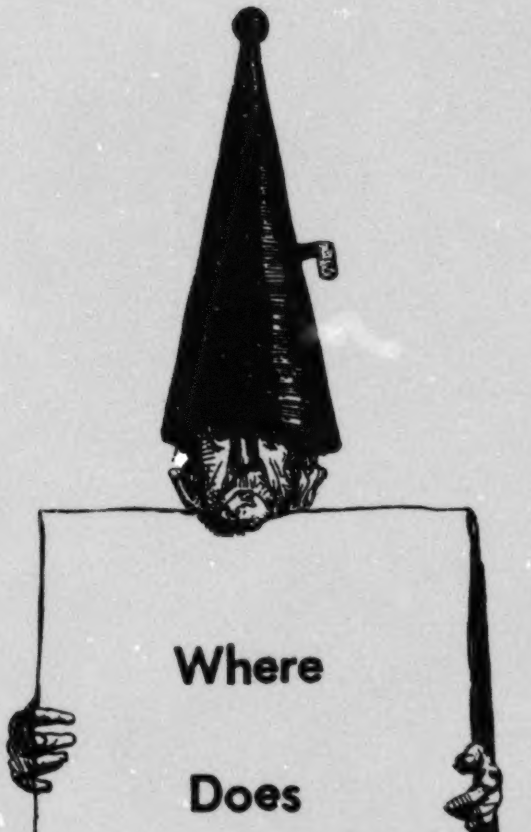
WHAT KIND OF GARBAGE?


Milk
Tomatoes
Ticket
Ride Ticket
Pestici
Feed

OVER

Draw or write down other kinds of garbage that match under the "WHAT KINDS OF GARBAGE" column.

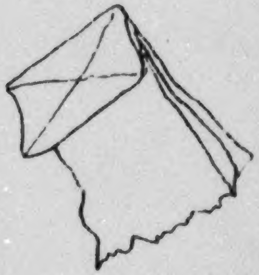
WHO	WHAT KINDS OF GARBAGE?
	
 7×6=? 4÷2=? 6+?=12 TEACHER	
 IN OUT Shirley SECRETARY	
 MEAT HAM 169/lb BUTCHER	


Where
Does
Garbage
Go ?

CESC
CETA
3-4

ACTION CARD A1

WHAT'S GARBAGE ?



BIG IDEAS:

Garbage is anything that people throw away.

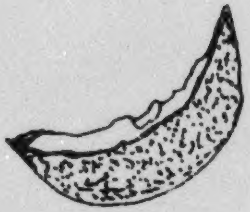
It is made up of different things.

Think of garbage you throw away. What is it made up of?

List it on the back page under the correct column.

If you throw away a plastic cup, list it under the plastic column.

Glass bottles and jars go under the glass column.



OVER

PLASTIC	PAPER	GLASS	METAL	WOOD	FOOD SCRAPS	OTHER

WHERE DOES GARBAGE GO?

Action Cards A3

Here is a play about where your garbage goes. In some stories the animals talk and behave just as people do. In this story the garbage talks and behaves like people. They tell us what happens to garbage.

CHARACTERS

JOHNNY JONES

DAN THE CAN

FOIL PHIL

BOTTLE BILL

NEWSPAPER NELLY

POLLY PLASTIC

NEIL THE PEEL

ELLEN THE MELON

ANNIE APPLE

FLIP TOP FIVE

SIX PACK SINGERS

NARRATOR

JOHNNY'S FATHER

WATCH FOR THESE
KEY WORDS:

Litter

Recycle

Recycling center

Reuse

Source separate

Incineration

Sanitary landfill

Composting

ACT 1

NARRATOR: *Johnny Jones is walking home from school. He follows his usual path through the strawberry patch, across the baseball field and along the stream that leads to his backyard.*

1 *It is a hot afternoon. Johnny decides to lean up against an old oak tree and soak his tired feet in the cool running water. As he looks into the sparkling water he sees an aluminum soda can lying on the bottom. He stares at the can thinking. . . thinking. . . thinking.*

(Johnny drifts into a deep sleep and begins to dream.)

JOHNNY: **That can looks awful. I wonder who threw it in the stream. Why do people** *litter*? **Maybe I should pick it up.**

(Johnny reaches into the water and picks up the can. Suddenly the can speaks.)

2 **DAN THE CAN:** **Whew! Thanks, I don't think I could have held my breath much longer.**

JOHNNY: **My name is Johnny Jones. Who are you? How did you get here?**

DAN THE CAN: **I'm Dan The Can. Some thoughtless person tossed me here. It happens alot.**

JOHNNY: **Well, where do you belong?**

DAN THE CAN: **I belong in the garbage can with the rest of my friends.**

JOHNNY: **Where do you go from there?**

DAN THE CAN: **The garbage man picks us up once a week. He takes us for a ride. Then we all go different ways.**

JOHNNY: **What do you mean? Where do you go?**

DAN THE CAN: **You seem like a nice person. Why don't you carry me up to the garbage can on the corner? You can meet my friends and see where we go.**

NARRATOR: *Johnny brings Dan The Can to the corner garbage can. They both get in and wait. Soon after the garbage truck arrives. A man dumps the garbage can into the back of the truck and rides off.*

ACT 2

3 **JOHNNY:** Wow! It's dark in here.

DAN THE CAN: It will take a while for your eyes to adjust to the dark.

(After a few minutes, Johnny can see. He is able to make out the shapes of pieces of garbage around him. He hears voices.)

JOHNNY: Dan The Can, Where are those voices coming from?

DAN THE CAN: Oh! I'm sorry, Let me introduce you to my friends.

(SHORT PAUSE)

4 **DAN THE CAN:** This is Foil Phil.

FOIL PHIL: Pleased to meet you Johnny. Excuse my wrinkled suit; I've been wrapped around a chicken leg to keep it fresh. I can't wait to be *recycled.* Maybe in my next life I'll be an aluminum soda can like Dan The Can.

JOHNNY: What do you mean be *recycled?*

FOIL PHIL: To *recycle* something means to change it's shape and to use it over again. I am now a piece of aluminum foil but if I go to the *recycling center* I might return as a soda can. This way I'm not wasted.

JOHNNY: Who are they over there? They look happy.

5 **FLIP TOP FIVE:** *(SAY TOGETHER)* Hi, we're The Flip Top Five. We're going to be *recycled* too.

(SING TOGETHER TO THE TUNE OF "ROW, ROW, ROW, YOUR BOAT.")

MELT,MELT, MELT US DOWN
THIS IS WHERE WE START.
FROM HERE YOU CAN MAKE
WHATEVER YOU WANT - A
TOOL, A CAR, A PART.

JOHNNY: Who's that guy coming toward us?

BOTTLE BILL: Hi!, I'm Bottle Bill. What's going on over here?

JOHNNY: Foil Phil and the Flip Top Five told me that they were going to be *recycled.* What's going to happen to you?

6 **BOTTLE BILL:** I thought you would never ask. Let me introduce my group The Six Pack Singers. We are all going to be cleaned and *reused* as soda bottles again. Hit it gang!

(Sing together to the tune of "Johnny Comes Marching Home")

SIX PACK SINGERS:

"WE'RE GONNA BE USED OVER AGAIN
HOO RAH, HOO RAH!
WE'RE GONNA BE CLEANED AND FILLED AGAIN
HOO RAH, HOO RAH.

WE WON'T BE DUMPED INTO THE GROUND—
WHERE THERE'S A CHANCE WE WILL NEVER
BE FOUND.

WE'RE BEING REUSED AGAIN AND AGAIN
FOR US THERE SHOULD BE NO END."

ACT 3

7 *NARRATOR:* *The garbage truck screaches to a stop. The trash men jump off and load three more cans of garbage onto the truck. Johnny, peering out through the garbage in the truck, notices a neatly stacked pile of newspapers standing next to the garbage cans.*

JOHNNY: Hey Dan, look, the garbage men forgot to pick up the pile of newspapers next to the trash cans.

DAN THE CAN: That's not just a pile of newspapers. Thats Newspaper Nelly.

JOHNNY: Why isn't she coming with us?

DAN THE CAN: Go ahead and ask her yourself.

(Johnny yells out from the back of the truck.)

JOHNNY: Hey, Newspaper Nelly, why don't you come with us? We have plenty of room in here. Come on!

NEWSPAPER NELLY: Oh! No thanks, I already have a ride. You see, I'm *source separated.*

JOHNNY: *Source separated,* What does that mean?

NEWSPAPER NELLY: Well, a long time ago, before people knew better, I used to ride with the rest of the garbage. Everytime I did, I would get all mixed up. Now people put me in a pile after they read me. I stay separated from the other garbage. This keeps me cleaner. It is easier for me to be *recycled.* I wish that all of my paper friends could come with me.

(Johnny is confused.)

JOHNNY: Where do your paper friends go?

NEWSPAPER NELLY: Many of them are brought to a large building to be burned. This is called *incineration.*

JOHNNY: Do they really get burned up? That seems like a big waste.

NEWSPAPER NELLY: Not really. Sometimes the heat that the garbage gives off is trapped and used to heat people's homes.

JOHNNY: That's very interesting, Newspaper Nelly. Thank you for telling me.

(THE TRUCK STARTS ROLLING)

JOHNNY: Bye - Bye, I have to go now. Good luck.

NEWSPAPER NELLY: Bye - Bye.

ACT 4

NARRATOR: *The garbage truck rides down the road. Johnny turns and talks to Dan The Can.*

JOHNNY: Newspaper Nelly seems happy. She likes to be *source separated* and *recycled.*

DAN THE CAN: Yes, she enjoys being *recycled* and made into new paper over and over again.

(Johnny looks towards the back of the garbage truck)

8 **JOHNNY:** What about that piece of plastic over there? She doesn't look too happy. Isn't she going to be *recycled* too?

DAN THE CAN: Oh, that's Polly Plastic. No, she isn't going to be *recycled.* She is sad because she used to be a useful plastic bag, now she is going to be buried in a *sanitary landfill.*

JOHNNY: *Sanitary landfill?* What's that?

DAN THE CAN: Ask Polly yourself. She will tell you.

JOHNNY: Hello Polly. My name is Johnny. Dan The Can says that you are going to a *sanitary landfill.* Will you tell me more about it?

(Polly is crying)

POLLY PLASTIC: Yes, I have never been there before but this is what I've heard. I am going to be dumped into a large hole and covered with soil, then big bulldozers drive over the top. This happens to alot of garbage that is not *reused* or *recycled.*

JOHNNY: Why can't you be *reused* or *recycled?*

POLLY PLASTIC: Well I could, But many times people just don't care. It's a shame that people don't want to take the time to *recycle* me like they do with Newspaper Nelly.

JOHNNY: I never thought about that. Gee, I hope they *recycle* plastic soon. You seem like such a nice plastic bag. Good luck Polly Plastic. Thanks for talking to me.

POLLY PLASTIC: You're welcome Johnny. It was nice meeting you.

ACT 5

9 *NARRATOR:* *The garbage truck comes to a stop again. The trash men hop off the truck and load two more bags of trash into the truck. Dan The Can sees a few of his old friends coming aboard the truck. He calls to them.*

DAN THE CAN: Hey! Neil The Peel, Ellen The Melon, Annie Apple, how have you been? Come to the back of the truck; I have a friend I'd like you to meet.

NARRATOR: *(Neil, Ellen, and Annie all climb into the back of the truck.)*

DAN THE CAN: This is Johnny. He wants to know where garbage goes.

NEIL, ELLEN & ANNIE: *(Say together)* Hi Johnny, We will tell you where we're going. We were all grown from the ground. Now we should return to the ground. This is called *composting.*

(Neil, Ellen, and Annie sing together to the tune of "Over the River and Through the Woods")

> "APPLES AND PEACHES AND WASTED FOOD, THE GARBAGE
> CAN WE LOAD. WE HOPE TO AWAKEN, TO FIND OURSELVES
> TAKEN, OUT TO THE SIDE OF THE ROAD."
>
> "OUT OF THE TRASH CAN AND INTO THE TRUCK,TO THE
> COMPOST HEAP WE GO. WE'RE GONNA BREAK DOWN, AND
> NOURISH THE GROUND, TO HELP THE GARDEN GROW."

JOHNNY: *(Clapping)* That was a neat song. Thank You. I never knew that some garbage could be used to help plants grow.

(The truck comes to a stop. Dan The Can calls to Johnny.)

DAN THE CAN: Well, Johnny, this is the end of our trip. We are at the Resource Recovery Plant. This is where we all go our separate ways.

JOHNNY: Thank all of you little pieces of garbage for being so helpful. You have answered many questions that I had about garbage. I wish all of you the best of luck.

DAN THE CAN: Good-bye Johnny. Maybe we will meet again.

JOHNNY: I hope so. Hey Dan, how will I know if it's you? You didn't tell me what you wanted to be made into.

DAN THE CAN: Well, it really doesn't matter to me. Just as long as I know that I am not being wasted. That's what's important to me.

ACT 6

10 *NARRATOR:* *The scene is back at the stream. Johnny's father is walking around calling for him. Johnny is still sleeping at the edge of the stream.*

JOHNNY'S FATHER: *(Calling)* Johnny, Johnny.

(Johnny suddenly wakes up. He looks down into the stream and sees the old soda can.)

JOHNNY: *(Sits up)* Dan, Dan The Can. What are you doing back in the stream? I thought. . . .

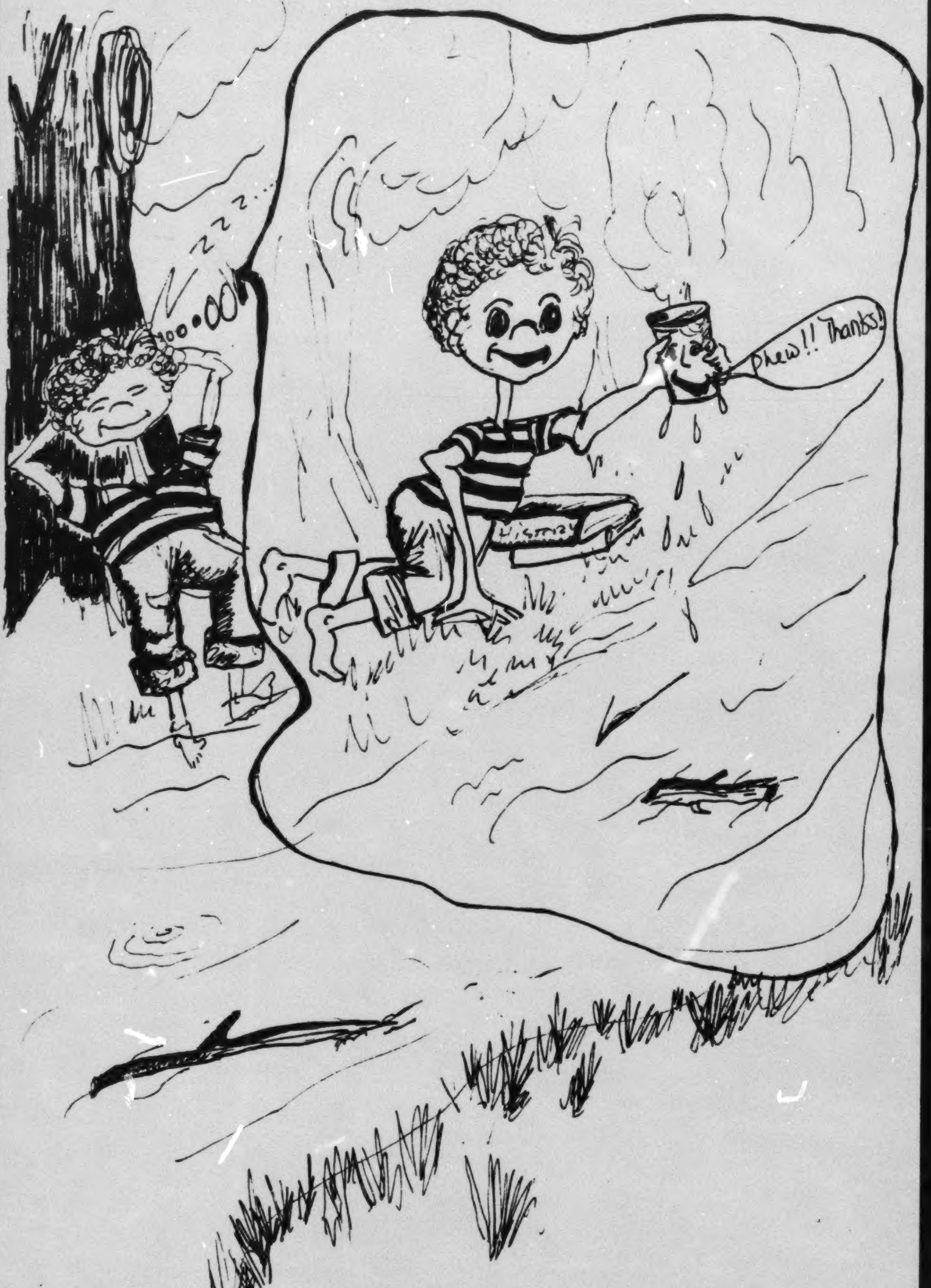
JOHNNY'S FATHER: Johnny, who are you talking to? *(confused)* What are you doing? Where have you been? You're late for dinner! You Mother is worried.

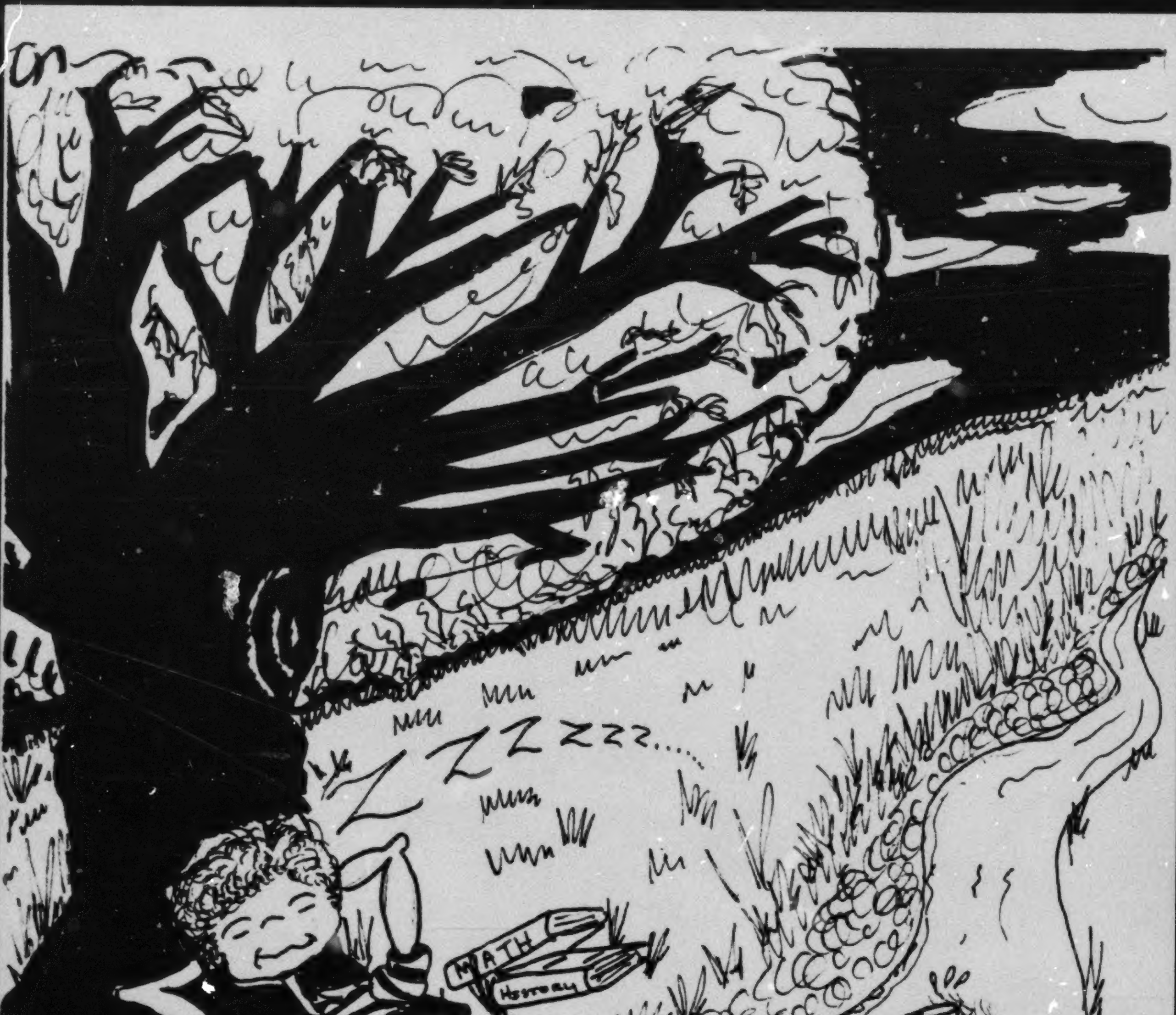
(Johnny's father takes Johnny by his arm and starts leading him home. Johnny tries to explain)

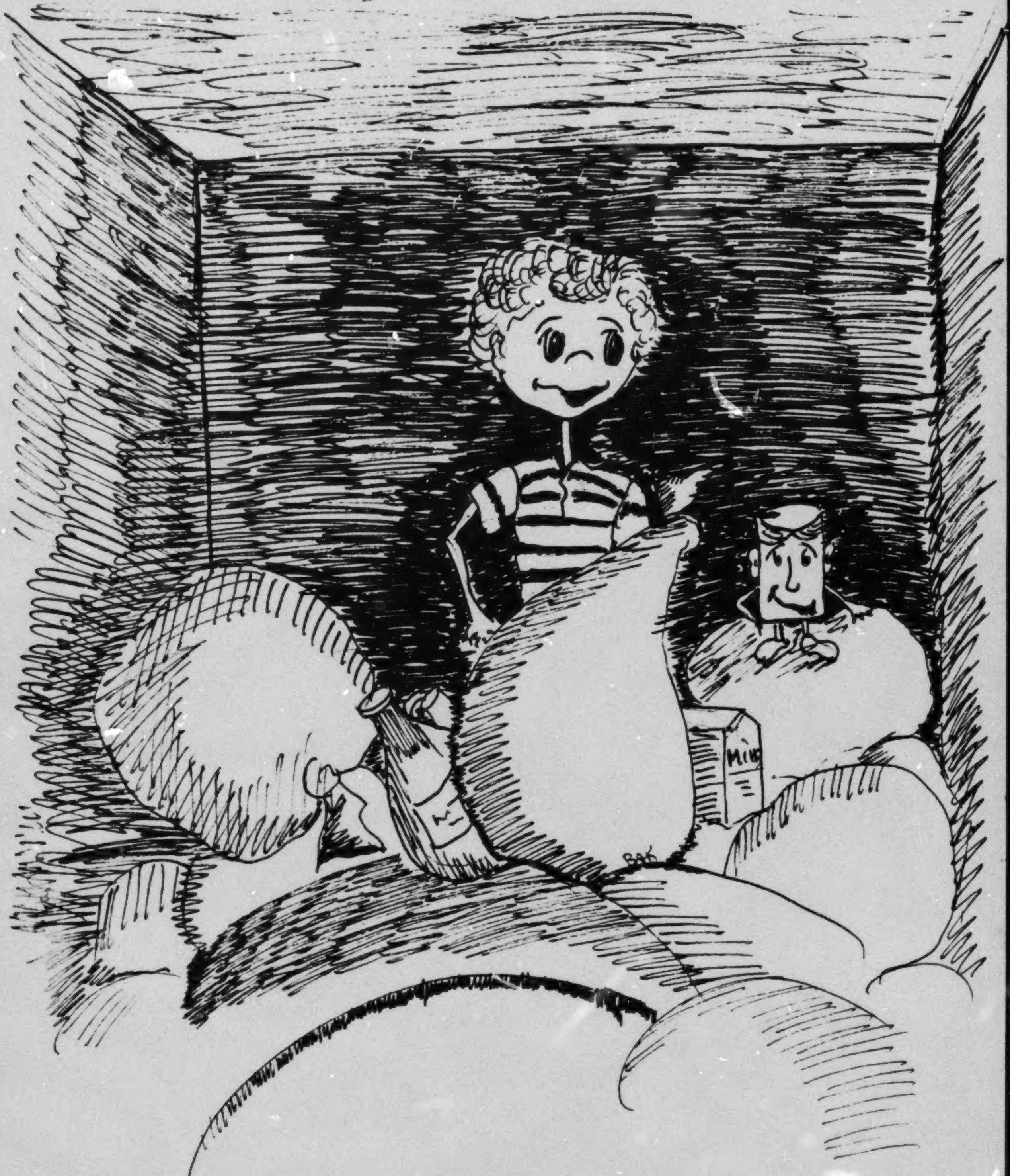
JOHNNY: But Dad, I met a can. It talked to me. We rode in a trash truck. I talked with other trash. A bottle named Bill.. I'm telling the truth. . . Honest Dad!

NARRATOR: *Johnny's father continues walking towards home, dragging Johnny along with him. Johnny trys to make him understand. Johnny's father laughs and shakes his head. Johnny turns and looks back at Dan. He smiles and waves knowing that one day they will meet again.*

THE END

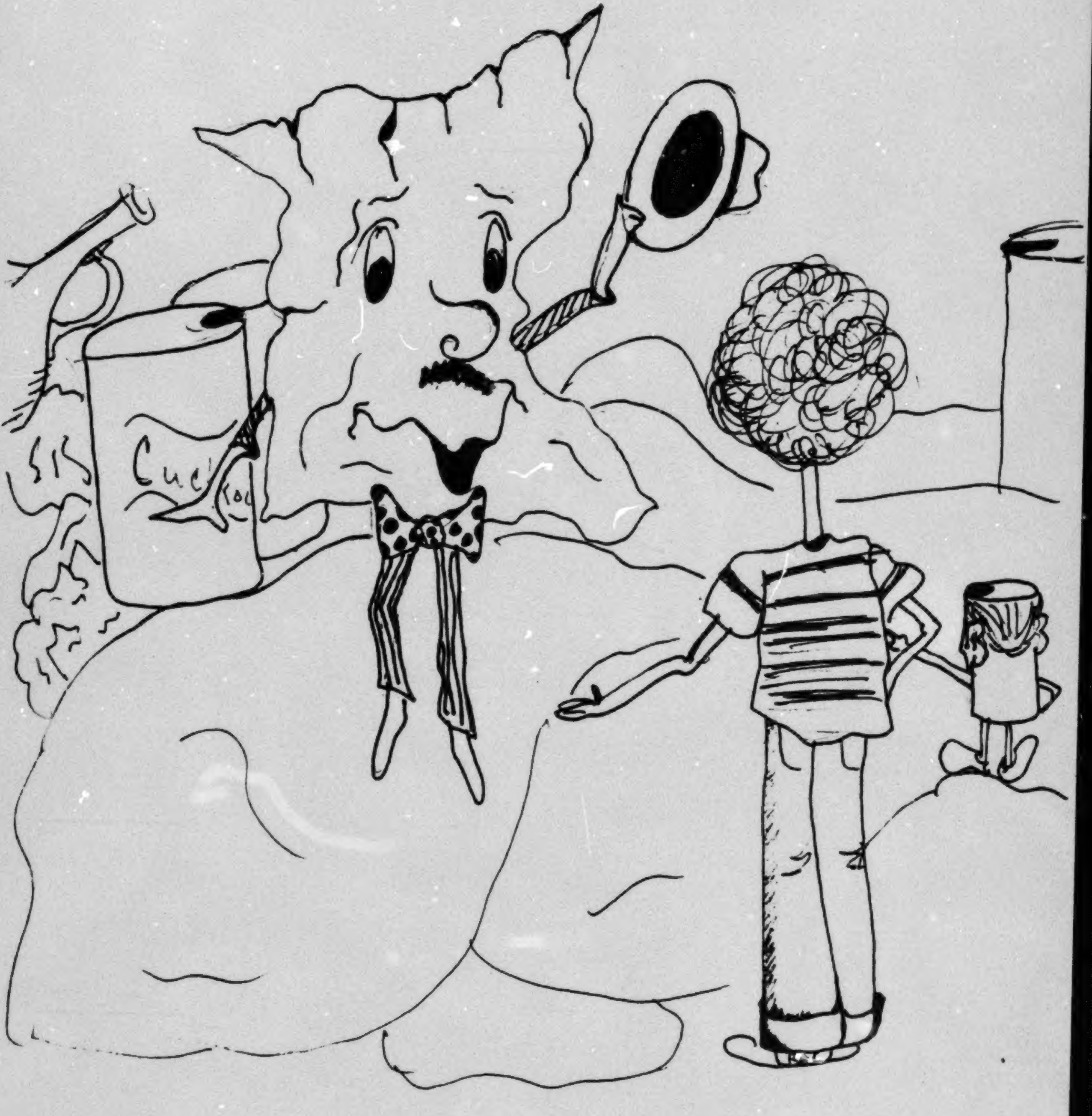

zzz...
ooo•OO
HISTORY
Phew!! Thanks!


ZZZZZZ......
MATH
History
SODA

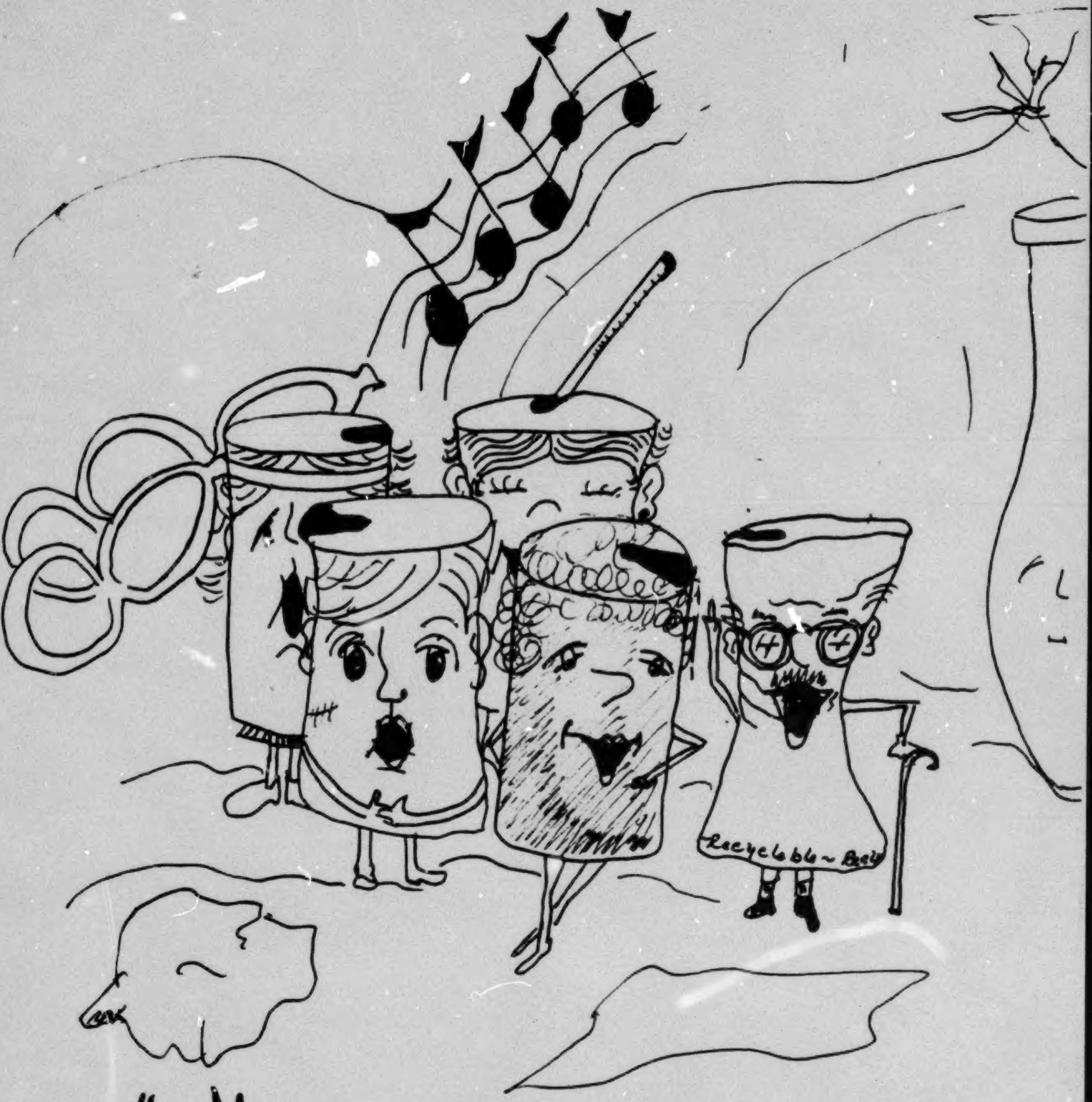


"Wow! It's dark in here!"

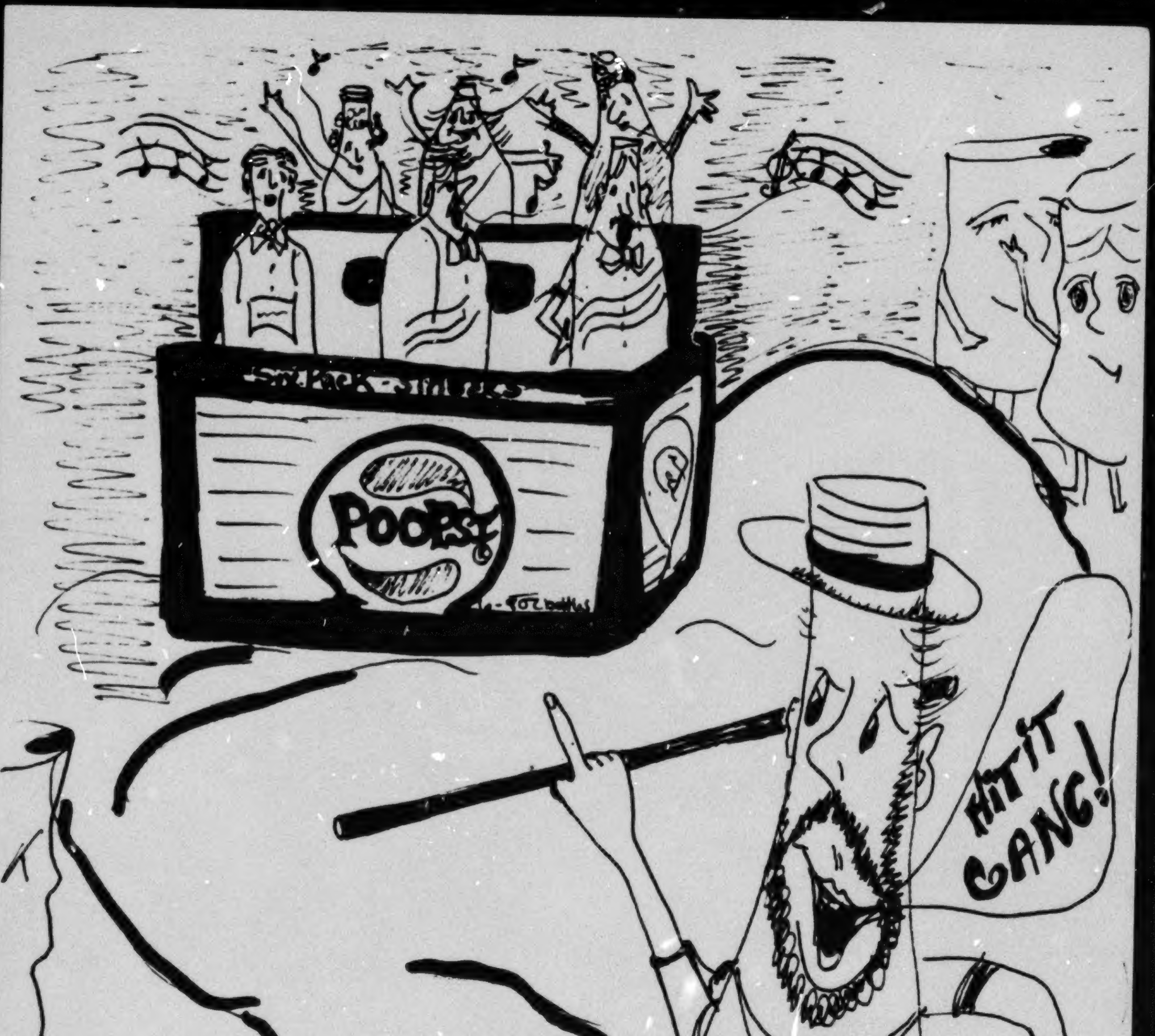
"Foil Phil"



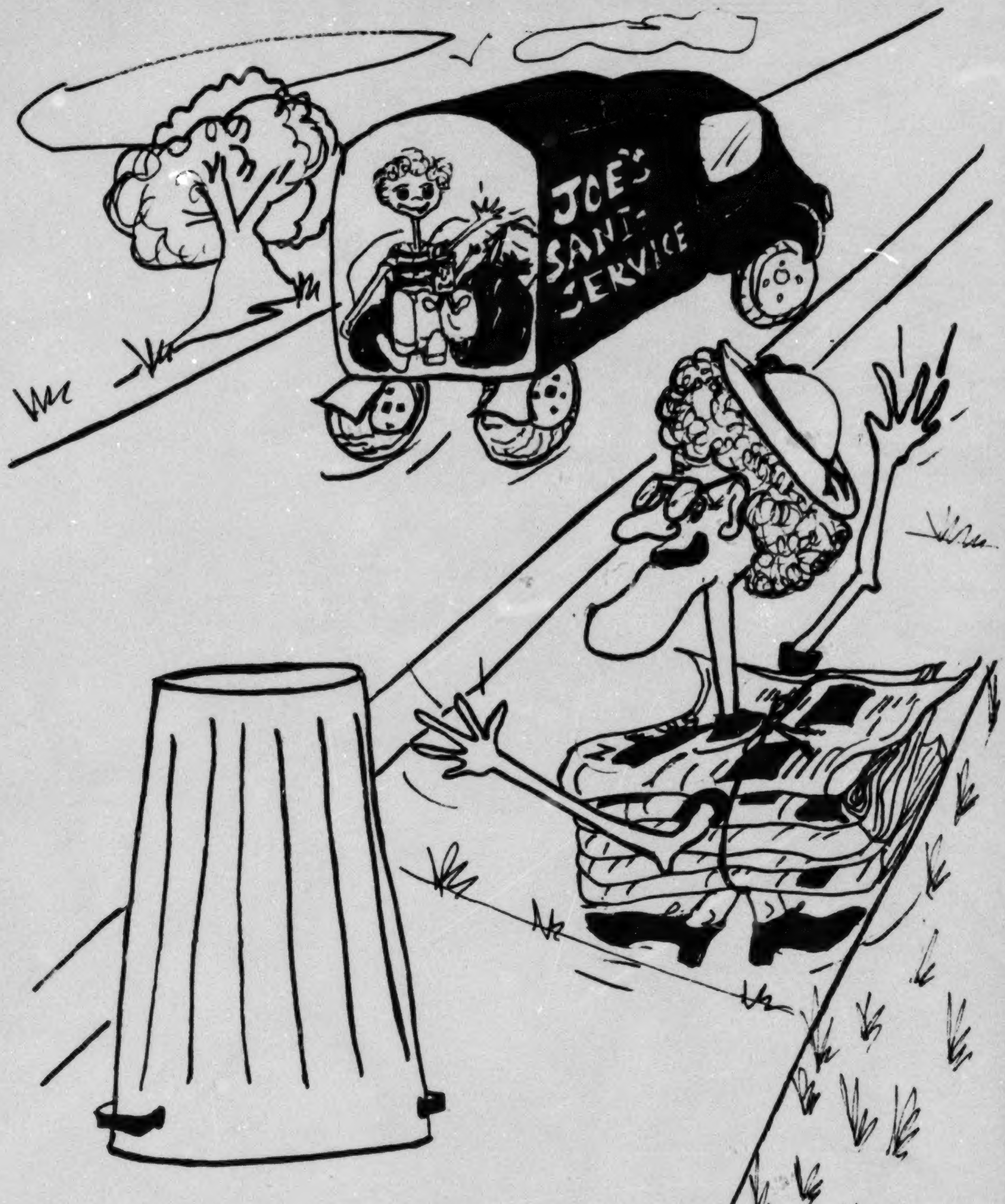
"Excuse my wrinkled suit..."


Recyclable ~ Beer

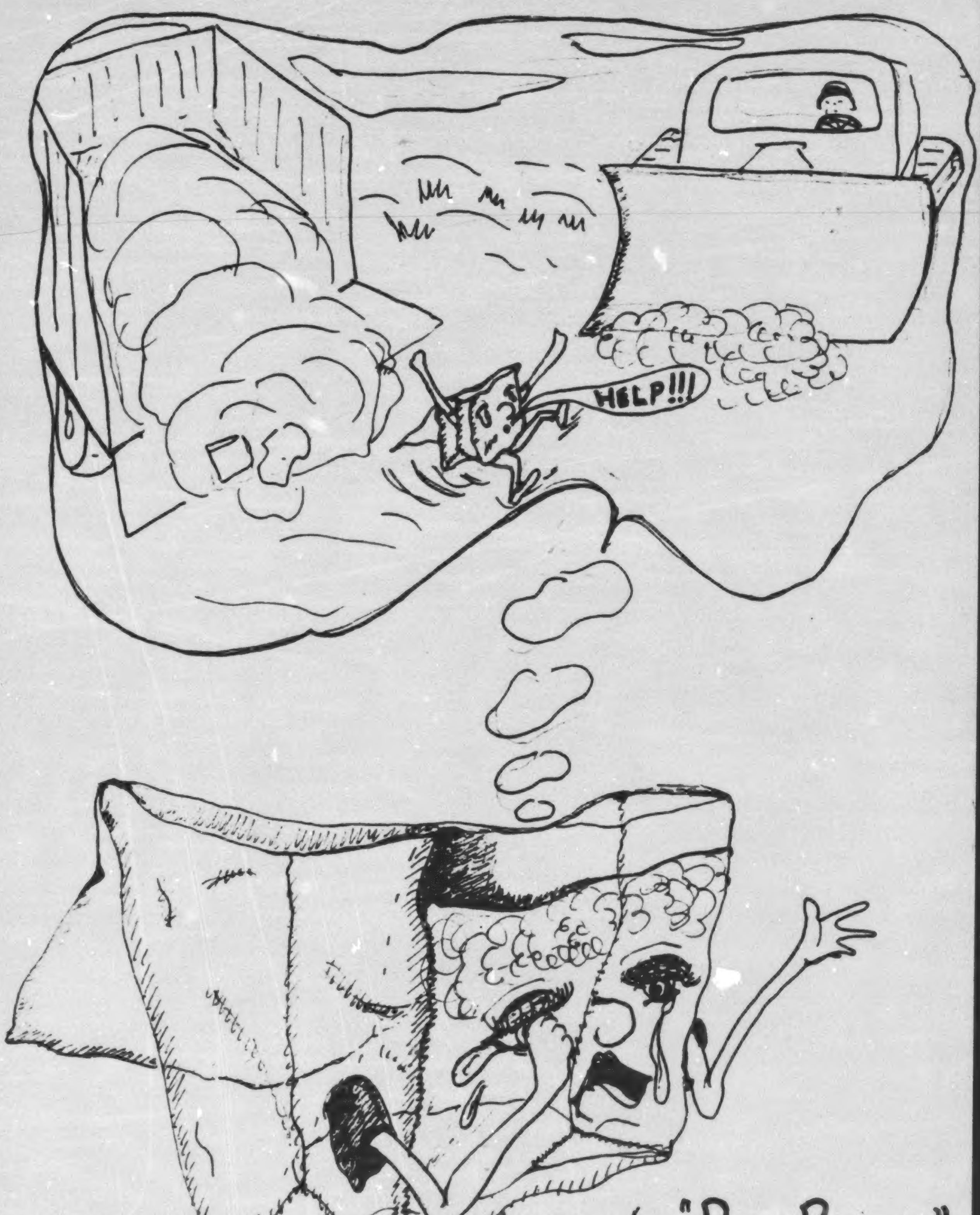
" Melt, melt, melt us down . . . "


SIX PACK SINGERS
POOPSI
HIT IT GANG!
NET WT 12 OZ

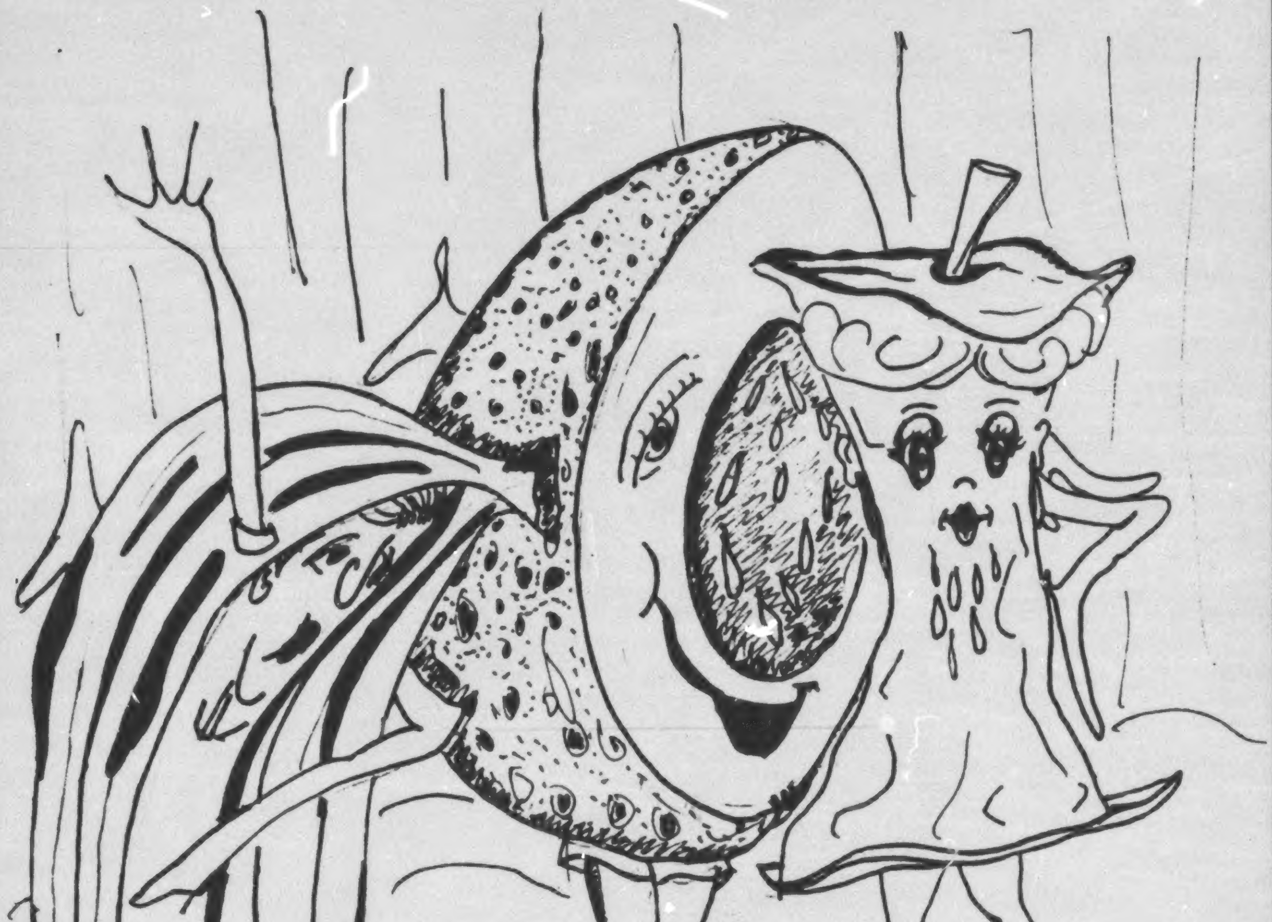
"We're gonna be used over again..."


JOE'S SANI-SERVICE

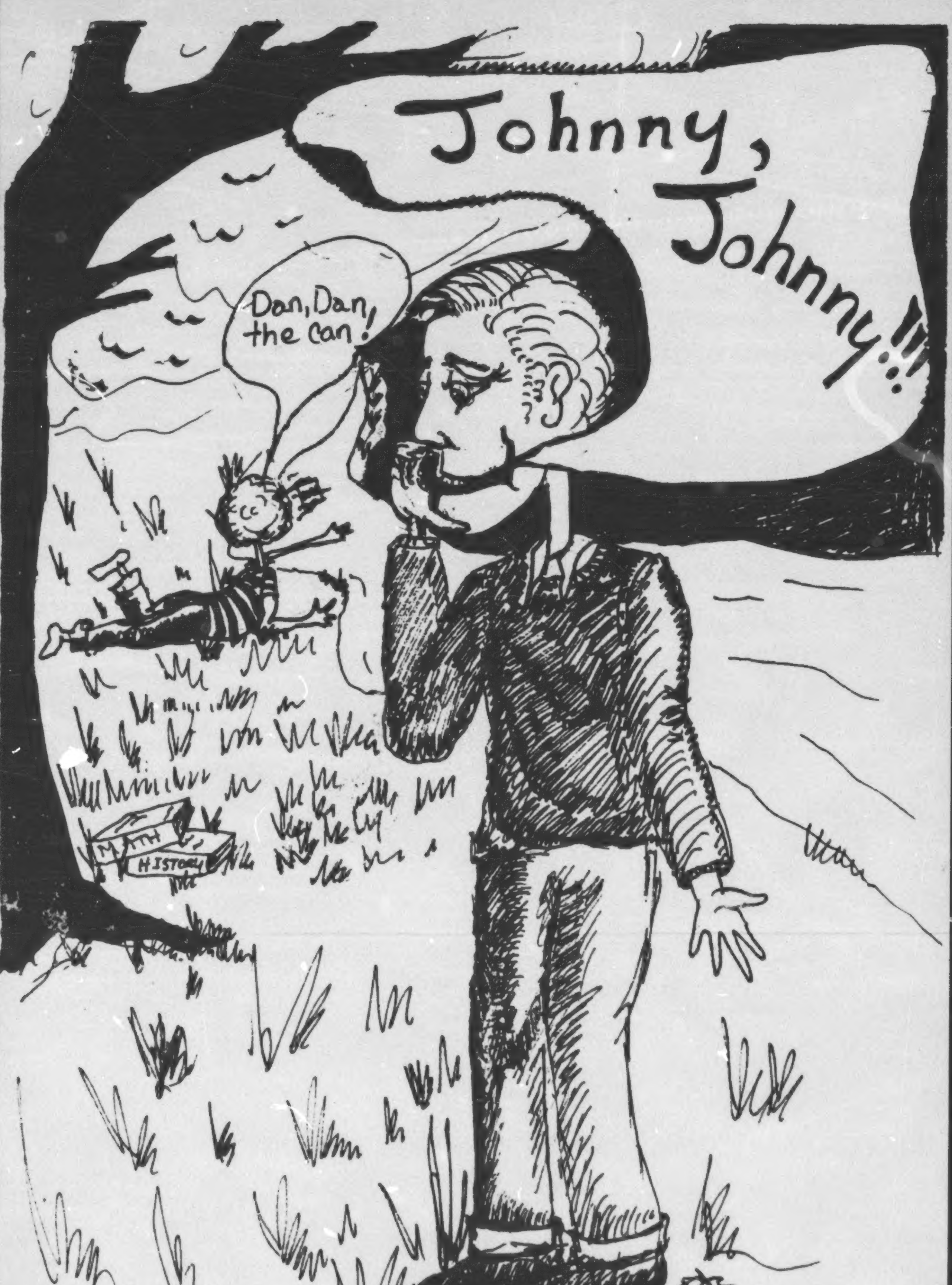
"Newspaper Nelly"



"POLLY PLASTIC"

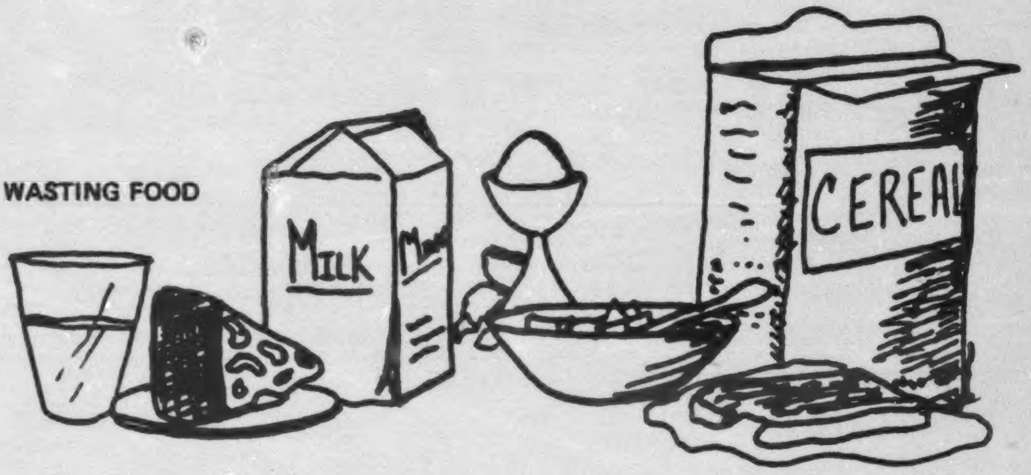

Neil the Peel
Ellen the Melon
Annie Apple

"Out of the Trash Can and into the Truck..."


Johnny, Johnny, Johnny!!!
Dan, Dan, the can!
MATH
HISTORY

ACTION CARD A4

WASTING FOOD


MILK
CEREAL

BIG IDEAS:

People waste much food. This food becomes garbage.

This is bad because:

1. We already have too much garbage.
2. Food costs money.
3. Many people in the world are starving.

Peanut Butter

OVER

What food is wasted in your lunchroom? Is food wasted at home? Use the chart below to list what foods you see wasted.

MEAT and POULTRY	DAIRY PRODUCTS	GRAIN PRODUCTS	FRUIT and VEGETABLES
Beef Fish Eggs Chicken Turkey	Milk Cheese Cream Ice Cream Butter	Bread Cereal Noodles Rice	Apple Pears Peaches Tomatoes Corn Peas

ACTION CARD A5

A HOME WITHOUT A GARBAGE TRUCK

BIG IDEA:

Everybody makes garbage or trash at home. If someone did not take the trash away, it would stay there.

You may have seen a big noisy truck in front of your home. This is the garbage truck. The men on the truck are trash collectors. They sometimes come early in the morning. Their job is very important. They come to take the trash away from your home.

1) Turn the page over. There is a picture of a house. Pretend it is your home.

2) Pretend that the trash truck stopped coming to your house.

3) Think of what would happen to all the trash and garbage.

4) What would the inside of your house look like?

5) What kind of trash might you find in each room?

6) What room in your house makes the most trash? Why?

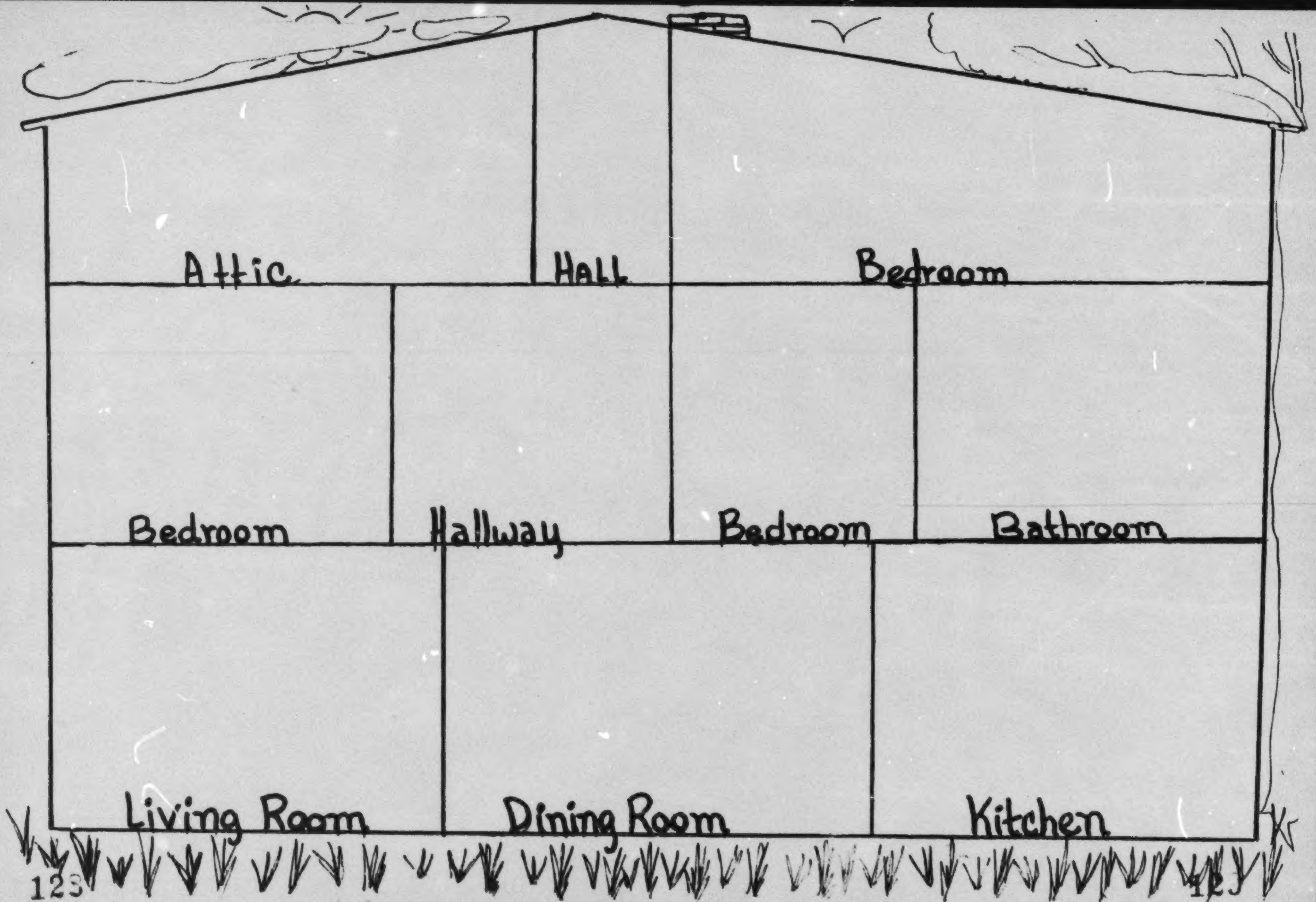
7) Who makes the most trash in your home? Why?

8) Draw pictures of the trash made in each room.

9) Write a short story about what would happen if the trash collectors stopped coming.

10) After you finish your story, share it with your friends.

OVER


Attic
HALL
Bedroom
Bedroom
Hallway
Bedroom
Bathroom
Living Room
Dining Room
Kitchen

The play also introduces the students to alternatives to present solid waste disposal methods. These alternatives include source separation, recycling and reuse. The play offers several choices to the teacher:

1. The teacher may read the play aloud to the class.
2. The teacher may assign the students parts to read aloud.
3. Under the teacher's direction, the play may be performed by the students before an audience.

A4 WASTING FOOD

SKILLS: Reading comprehension, recording observations, organizing information, sketching, values clarification working independently.

PREPARATION: None

People waste food when they discard it as garbage. A few disadvantages of wasting food are:

(1) Increase in the amount of garbage we must dispose of.
(2) Food costs money and uses energy in its production.
(3) Starving people throughout the world need the food. Malnutrition is a worldwide problem.

In this lesson the students record what foods they see wasted at lunch in the cafeteria. They may then discuss in class some of the disadvantages of wasting foods.

Before they fill out their Action Cards at lunch, a short discussion on the importance of a balanced diet (4 food groups) will help to clarify the Action Cards. After lunch the following questions may help to initiate a class discussion.

– What kind of food was wasted the most today?
– Did you waste food at lunch? What kind?
– Why did you waste it?
– Is food wasted at your house? What kind?
– Do your parents get mad when you waste food?
– If yes, why do they get mad?
– What is wrong with wasting food?
– Does it prevent you from getting a balanced diet? If yes, how?
– Are people starving on the Earth? Where? Is this a good reason to stop wasting food? Why?
– Does food cost money? When you waste food do you waste money?
– What other reasons can you think of to show that wasting food is bad?

A5 A HOME WITHOUT A GARBAGE TRUCK

SKILLS: Reading comprehension, organizing information, sketching, decision making, creative writing, working independently.

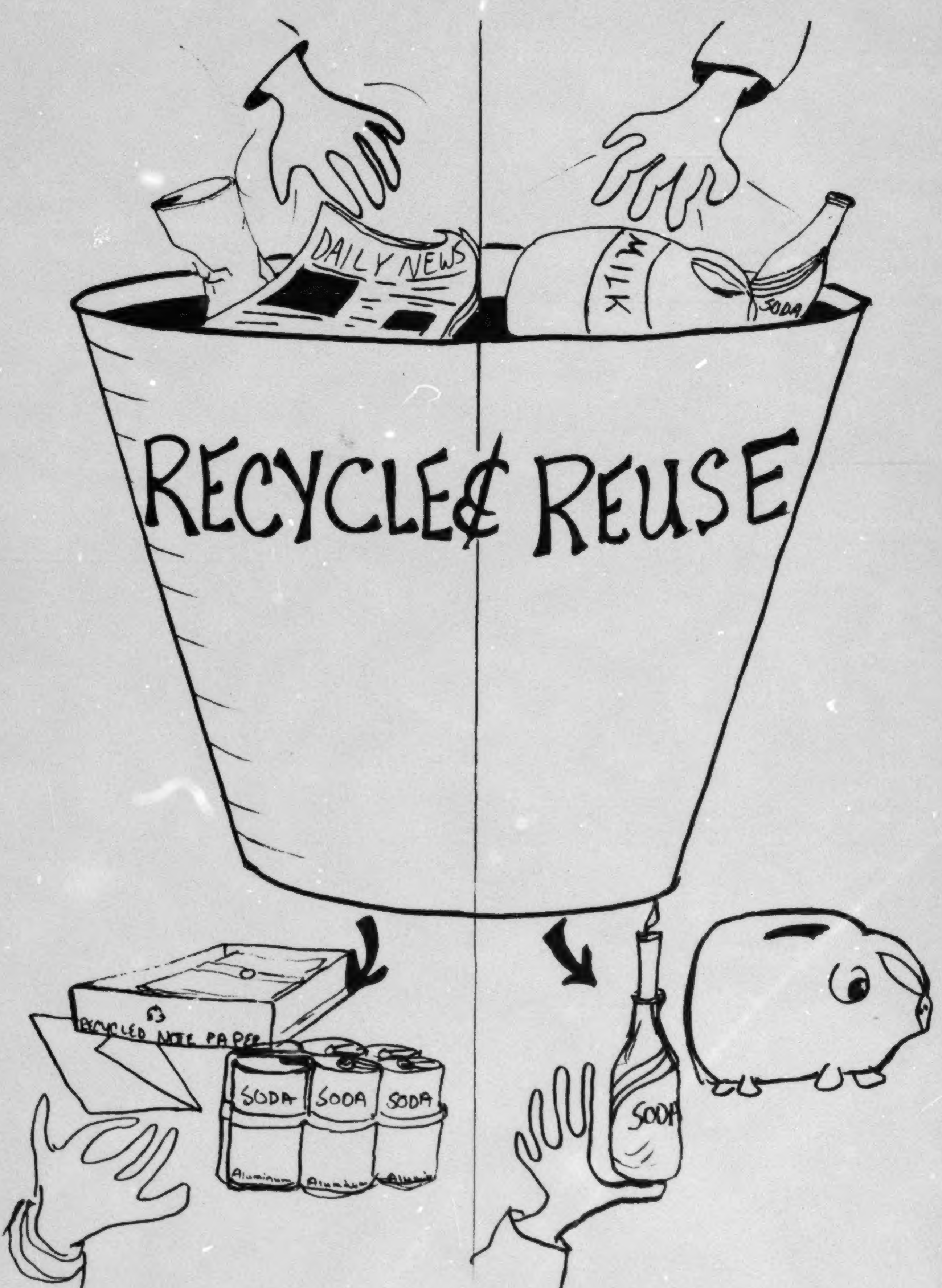
PREPARATION: None

If garbage was not removed from a house it would not take long for the house to fill up. The students may imagine what their house would be like without garbage pickup. They may draw pictures and write a short story. They can use the Action Card to draw on and stimulate their imaginations to write the story. After they have written their stories, encourage the students to share them with each other.

AFTER CARRYING OUT THE 5 ACTIVITIES IN THIS UNIT THE STUDENTS WILL BE ABLE TO:

	Activities Which Meet These Objectives
1. Define the word "garbage".	1
2. Identify what materials make up garbage.	1
3. List at least 4 sources of garbage.	2
4. Identify the kinds of garbage produced by these sources.	2
5. Recognize and explain three different methods of solid waste disposal.	3
6. List and describe 3 solid waste disposal alternatives, i.e. recycling, reusing, and source separation.	3
7. Identify the kinds of food wasted daily in school and at home.	4
8. List 3 disadvantages of wasting food.	4
9. Identify the importance of trash collection at home.	5
10. Describe the problems created when garbage is not collected.	5

CESC
CETA
3-4


DAILY NEWS
MILK
SODA
RECYCLE & REUSE
RECYCLED NOTE PAPER
SODA
SODA
SODA
Aluminum
Aluminum
Aluminum
SODA

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING ACTIVITIES:
(Each of the Action Cards may be reproduced individually for the students to work on)

B1 REUSE YOUR TRASH

PREPARATION: See each activity

SKILLS: Reading comprehension, vocabulary, art.

This is a lesson to introduce the reuse of trash. In this lesson students may learn that much of what we presently throw away could be reused or made into something useful. Here are some student craft ideas which use materials recovered from trash. You may have been doing these or similar projects for years. It is hoped that some of these suggestions will be new. The emphasis is on the reuse of much material which is ultimately discarded or buried in a landfill.

MILK BOTTLE PIGGY BANK

MATERIALS: EMPTY PLASTIC MILK CONTAINER,
PAINT, GLUE, 4 OLD PENCIL STUBS,
PIPE CLEANER OR OLD TELEPHONE WIRE,
CARDBOARD (SCRAP), SCISSORS.

1. Cut a slot for coins in the center on the opposite side of the handle.
2. Paint, sketch or glue on a piggy face or another design for decoration (see sketch).
3. Insert the 4 old pencil stubs as legs. Glue them in place with the eraser ends down.
4. Use a pipe cleaner or bits of scrap telephone wire for a tail. Insert and glue it in.
5. Cut up the cardboard for the ears. Paint and glue them on.

MILK BOTTLE BIRD FEEDER

MATERIALS: EMPTY PLASTIC MILK CONTAINER
CORD OR ROPE, STICK OR DEAD BRANCH; THE THICKNESS OF PENCIL.

1. Punch 2 holes through the neck and insert the rope through it. This will serve as a hanger.
2. Cut out the side of the milk container (see sketch).
3. Insert the stick just below the bottom lip of the container (see sketch).
4. To help keep out the rain, leave the screw top on.
5. Fill the bottom with bird seed. The stick will serve as a perch for the birds.

COFFEE CAN FLOWER POT

MATERIALS: ANY SIZE COFFEE CAN,
PAINT, GLUE.

1. Decorate the can with paint, glue on pieces of scrap cloth or any other desired materials.
2. Be sure to check the edge of the lip for sharpness. File it down if necessary.
3. This pot can be filled with dirt or sand to make a flower pot for plants or dried flowers. The students may wish to use it as a pencil holder or other useful container.

REUSE YOUR TRASH

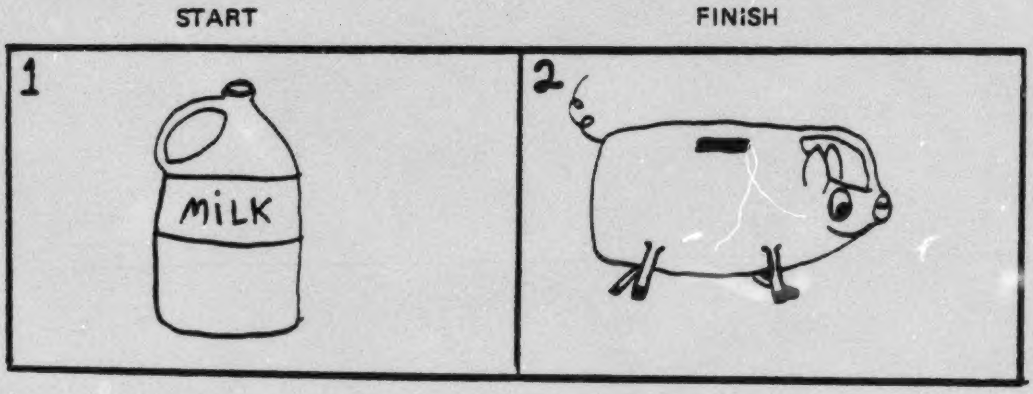
ACTION CARD B1

BIG IDEAS:

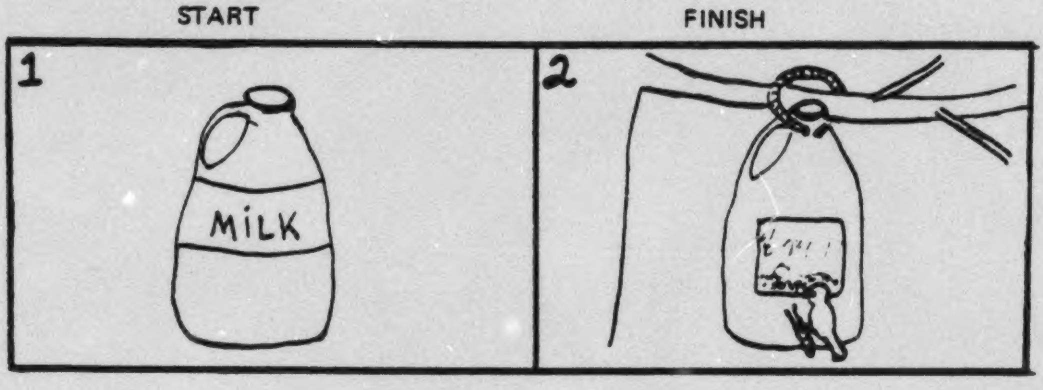
Garbage can often be made into something useful. It can be reused.

Below are pictures of garbage that you can reuse.

MILK BOTTLE PIGGY BANK

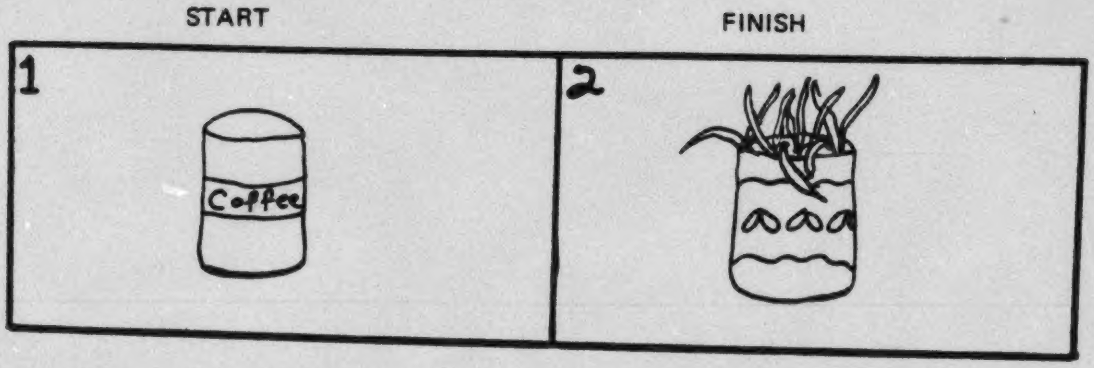

START
FINISH
1
MILK
2

MILK BOTTLE BIRD FEEDER

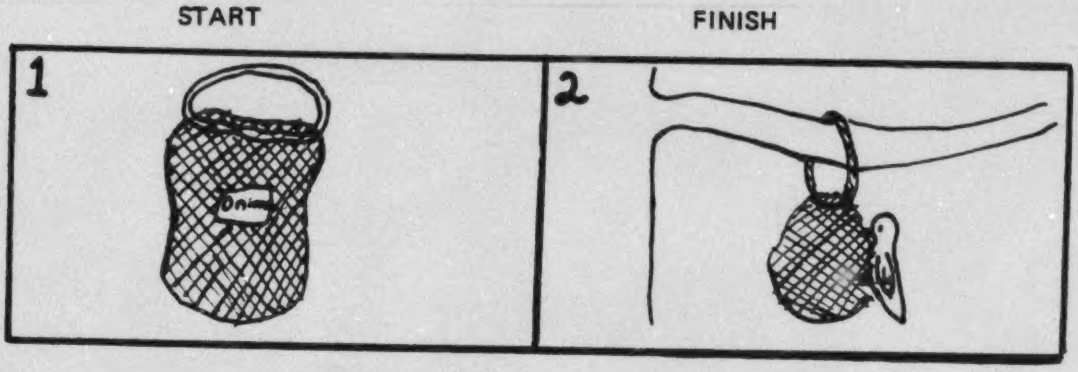

START
FINISH
1
MILK
2

OVER

COFFEE CAN FLOWER POT


START
FINISH
1
Coffee
2

ONION SACK SUET FEEDER


START
FINISH
1
Onion
2

ACTION CARD B2

EXPLORING RECYCLING

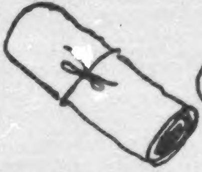
BIG IDEAS:

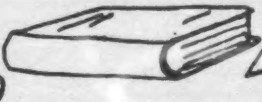
Trash and garbage can often be recycled. Recycling can change the way an object looks. For example: glass can be crushed, melted and made into new glass. Paper can be ripped up and smashed into new paper.

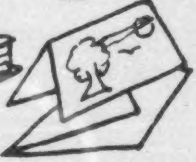
Below are pictures of recycled objects. Decide which objects do not belong in each group.

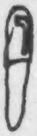
PAPER

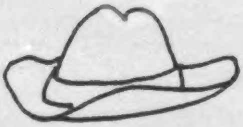
Step 1 Draw an X on the things that were not made from paper.







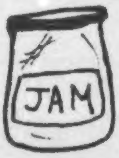


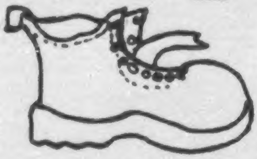


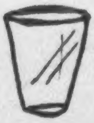
Step 2 Draw 3 other things that were made from paper.

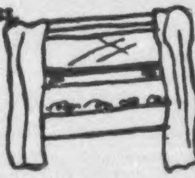
GLASS

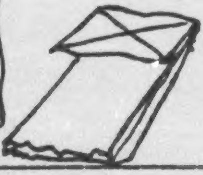
Step 1 Draw an X on the things that were not made from glass.









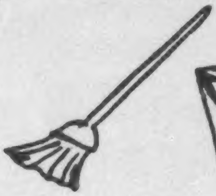


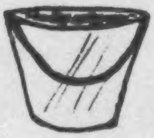
Step 2 Draw 3 other things that were made from glass.

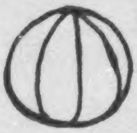
OVER

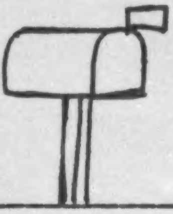
METAL

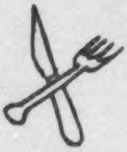
Step 1 Draw an X on the things that were not made from metal.

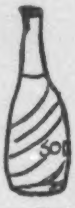








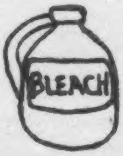


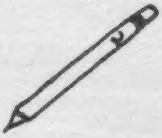


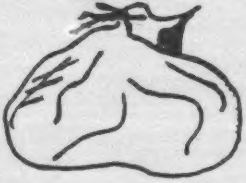
Step 2 Draw 3 other things that were made from metal.

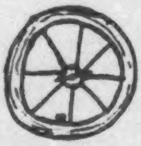
PLASTIC

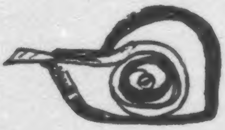
Step 1 Draw an X on the things that were not made from plastic.











Step 2 Draw 3 other things that were made from plastic

ACTION CARD B3

RECYCLING RELAY GAME

Below is the scoreboard for the recycling relay game. Listen to your teacher for directions.

TEAM 1	TEAM 2	TEAM 3	TEAM 4

B2 EXPLORING RECYCLING

SKILLS: Reading comprehension, vocabulary, set theory, sketching.

PREPARATION: None

Recycling differs from reusing in that the waste material is transformed into a new material. Below are a few examples of recycling:

--Paper products are soaked in water and chemicals. The resulting mash is compacted and dried into new paper.

--Glass is crushed, melted and formed by machines into new products. The glass must first be separated and grouped by color.

--Metals are separated according to their magnetic properties. Aluminum is not magnetic and is therefore easily separated from other metals.

--Plastics are not easily recycled. They can be shredded and mixed into soil to act as mulch. The sun's ultra-violet light rays will decompose plastic over a long time period.

The Action Card may be used to aid the student in relating waste materials to possible recycled items. If the blocks are too small for the students to draw in, scrap paper may be utilized.

B3 RECYCLING RELAY GAME

PREPARATION: Collect trash over a 2 - 3 week period

SKILLS: Set theory, group cooperation.

Over a 2-3 week period have the students bring in clean (washed) trash items. You may want to spend a few minutes each day having the students classify the trash into groups according to material make-up. For the Recycling Relay Game you will need 3 boxes of trash; paper, glass, and metal. Divide the class into 4 teams. Pick an article from the paper box and ask a student from Team One to describe an article that could be recycled from paper. Do the same for glass, and metal. Have the students record their answers in the blocks. If no response is given within 15 seconds, Team Two is allowed a chance to respond and Team One must leave the space blank. Each team may take turns responding to the questions. The team who fills up its columns first is the winner. You may vary the time allocation to make the game more or less difficult.

AFTER CARRYING OUT THE FOLLOWING ACTIVITIES IN THE RECYCLING AND REUSE UNIT, THE STUDENTS WILL BE ABLE TO:

		ACTIVITIES WHICH MEET THESE OBJECTIVES
1.	Demonstrate the reuse of one or more kinds of trash.	1
2.	Distinguish items which were recycled from various waste materials.	2
3.	Discuss the concept of recycling.	2
4.	List objects that paper, metal and glass can be recycled into.	3

CESC
CETA
3-4

LITTER-LY SPEAKING

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING ACTIVITIES:
(Each of the Action Cards may be reproduced individually for the students to work on).

C1 MAKE A LITTER MAP

SKILLS: Reading comprehension, sketching, map-making, group cooperation, values clarification, leadership abilities, recording observations.

MATERIALS: 24" x 36" poster boards or newsprint paper
3 - 4 different colored magic markers or substitutes

This lesson is designed to provide an introduction to mapping skills. It will also help the students generalize about why litter is found in some places more often than others. The students may walk in the neighborhood near the school or in a local area with much litter. On the walk they will draw the streets, sidewalks, houses, stores, parks, etc. that they see. Litter can be marked on the map with a black X.

Most teachers find it difficult to direct the activities of an entire class outside the classroom. One method of control is to utilize the assistance of several willing parents. This works well if the tasks of the students are clear to the parents. It may be helpful to divide the class into several groups and have them make their maps in groups of 4-5. Have each group bring an old grocery or shopping bag along to collect and dispose of the litter they find.

Each group may make its own litter map on a large piece of newsprint or poster paper. It helps the students if the paper is taped to cardboard or thin plywood the same size. The map outline may be drawn with a black magic marker. Special features and litter may be added with other colors. The adult leaders can help in making the general map outline, as dictated by the students abilities. For younger students you may want to provide the map outline in advance. Group and class discussions following the outdoor activity can help to develop generalizations about why litter is concentrated in certain places more than others.

C2 LITTERBUG REPORTER

SKILLS: Reading comprehension, organizing information, interviewing, oral communication, working independently, values clarification, research techniques, recording information.

MATERIALS: None

Many people litter at one time or another for different reasons. In this lesson the students find out about people who litter by interviewing friends, parents, grandparents and teenagers. It may be helpful to go over the questionnaire to clarify questions and problems. The students may substitute other people for parents, grandparents or teenagers that they may be unable to interview. After they have completed their interviews, have them bring in the questionnaire to compare and discuss the results. The last two questions may help to stimulate discussion.

ACTION CARD C1

MAKE A LITTER MAP

BIG IDEAS:

Litter is garbage which is thrown on the ground.

People litter at home. They litter at school.

They litter at work. They litter at the store.

Where can you find the most litter?

You may take a litter walk to find litter.

Rules for the litter walk:

1) Stay with your group leader.
2) Put all litter you find in a trashbag.
3) Do not add new litter to the neighborhood.
4) Do not pick up broken glass; report it to your teacher.
5) After the litter walk put the trashbag in a trashcan.
6) Wash your hands.

Draw your own litter map to show where you found litter. Draw a black X on the map at each place you found litter.

ACTION CARD C2

LITTERBUG REPORTER

BIG IDEAS:

Many people drop candy wrappers, paper cups, and soda cans on the ground. Sometimes a litter basket is only a few feet away.

To find out who litterbugs are, turn the page for the questions.

Ask 4 people the questions.

- 1 Parent (Mother or Father)
- 1 Grandparent (or older person)
- 1 Friend your age
- 1 Teenager (can be a brother or sister)

OVER

QUESTIONS	PARENT		GRANDPARENT		FRIEND		TEENAGER	
	Yes	No	Yes	No	Yes	No	Yes	No
1) Do you think litter looks nice?								
2) Do you see people litter?								
3) Do you stop them and ask them to pick it up?								
4) Do you pick it up?								
5) Have you littered?								
6) Do you litter now?								
7) Why do people litter?								
8) What can people do to prevent littering?								

ACTION CARD C3

LITTER POSTERS

BIG IDEAS:

Most litter is easy to see. It can be seen on sidewalks, streets and parks. Sometimes litter is in yards, ponds and streams.

Show people how you feel about litter. Draw a poster.

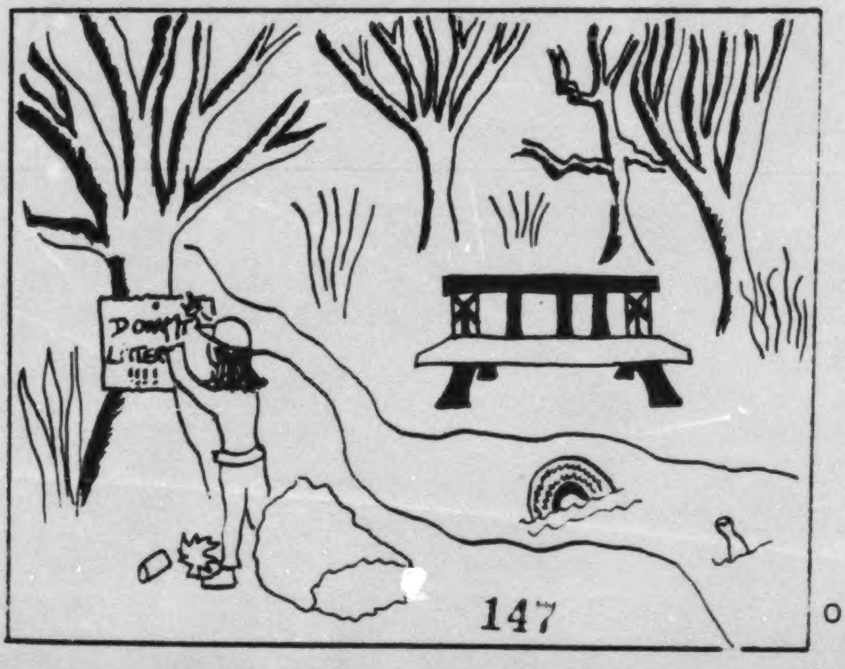
Here is how I made a litter poster:

I found a park by my house. It was full of many trees.

It was also full of litter.

There were no trashcans at the park.

So I made this poster:


DON'T LITTER !!!!

OVER

ACTION CARD C4

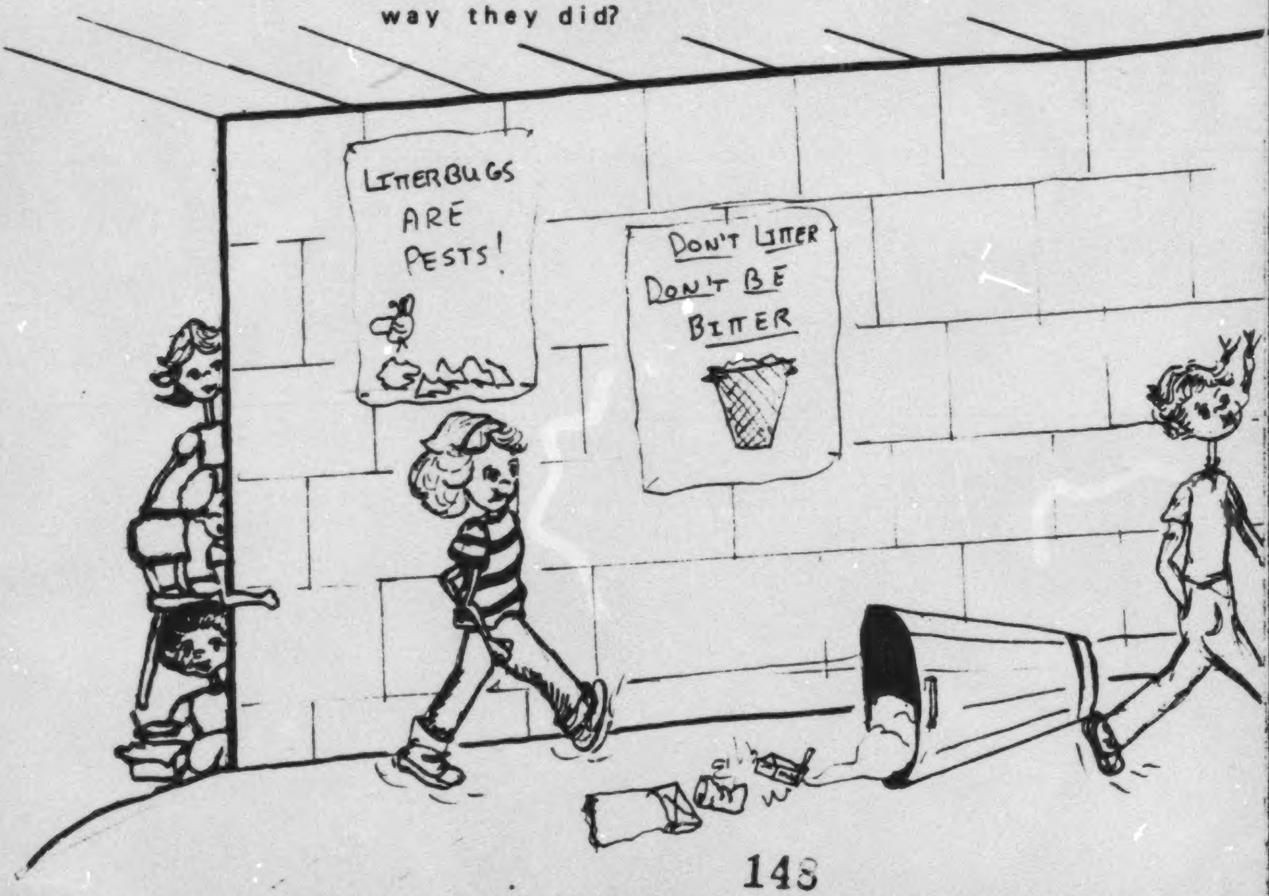
ACTIONS SPEAK LOUDER THAN WORDS

BIG IDEAS:

Most people think that litter is ugly. They say it should not be thrown around the school. They say it should not be thrown anywhere.

Do they act the way they think?
Here is a way to find out.

1. Set up the litter test with your teacher.
2. Fill out the charts. Use an X to mark your answer.
3. Talk to your friends about the tests they made.
4. Why did your friends act the way they did?


LITTERBUGS ARE PESTS!
DON'T LITTER
DON'T BE
BITTER

C4

" ACTIONS SPEAK LOUDER THAN WORDS "

WHAT THE KIDS SAID

PLACE WITH POSTERS		PLACE WITHOUT POSTERS	
Saw the poster		They see litter all the time	
Didn't see poster		They didn't see it	
Don't care about litter		Doesn't care about litter	
Usually pick up litter		They usually pick up litter	
Never pick up litter		Never pick up litter	
They didn't put it there		They didn't put it there	
Litter doesn't hurt anything		Litter doesn't hurt anything	
They thought someone else should pick it up		They thought someone else should pick it up	
Other things they said		Other things they said	

C4

WITHOUT LITTER POSTERS

	They picked it up	They walked by	something else
1.			
2			
3.			
4.			
5.			
6.			
7.			
8.			

WITH LITTER POSTERS

	They picked it up	They walked by	something else
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

C3 LITTER POSTERS

SKILLS: Reading comprehension, sketching, poster-making, working independently, values clarification.

MATERIALS: Oak tag, crayons,magic markers.

Litter is often seen along roadsides, sidewalks, in parks and fields, and in streams and lakes. By designing and drawing posters which describe how they feel about litter, the students can help to draw public attention to this problem. Ask the students to think of a littered place. They may use this place as a basis for their litter poster. They may also, however, design their litter poster around personal feelings on litter, animals and litter, or other themes.

C4 ACTIONS SPEAK LOUDER THAN WORDS

SKILLS: Reading comprehension, recording observations, group cooperation, interviewing, organizing information, values clarification.

MATERIALS: Litter posters, Masking tape, Clip boards
Tape recorders (optional).

This activity may be carried out with several class groups. The groups may be supervised by willing parents, (see Action Card C1 - Make a Litter Map). This is a situation behavior experiment to see if students will pick up litter spilled near a trash container. The students may assess the influence of their anti-litter posters made in the previous lesson by strategically placing them near the litter. (Use anti-litter posters made in C3: Litter Posters.) The activity may be completed without the posters if desired.

With administrative approval select several areas in the school where a trashcan may be overturned. Passing students should be easily observable. Each group may operate its own test site. If posters are available, display them at some test sites and not at others. Each group may have two students observe and record how the first eight passers-by reacted to the litter. A second team of two may record the acts of the next eight passing students. The two tables included on the Action Card may be used by the students to record the behavior of passing students . Two other students may interview the students who have already passed concerning why they reacted as they did. The tables accompanying the Action Card may be used for this purpose. Children who can obtain and use tape recorders may do so for this phase of the activity.

A class discussion to examine the results of the activity will help to clarify the generalizations.

AFTER HAVING COMPLETED THE ACTIVITIES CONTAINED WITHIN THIS LITTER UNIT, THE STUDENTS WILL BE ABLE TO:

	ACTIVITIES WHICH MEET THESE OBJECTIVES
1. Define the word "litter."	1
2. Describe one place where a lot of litter is found.	1
3. Name at least two reasons why people litter.	2
4. Identify at least one way to prevent littering.	2,4
5. Describe and draw their personal feelings about litter and littering.	3,4
6. Describe how people react when they see litter in their school.	4

CESC
CETA
3-4

SOLID WASTE/ENERGY CURRICULUM

TEACHER BRIEFS

For Teachers of Grades 5 and 6

INFORMATION JUST FOR YOU!

- *Why Teach About Solid Wastes?*
- *How To Use This Curriculum Special Features*
- *What About?*
    - *The Big Ideas*
    - *Evaluation*
    - *Grade Level Placement*
    - *Answers to Questions and Numerical Problems*
- *Getting Energy From Trash and Garbage*
- *Landfilling*
- *County Multi-municipal Source Separation Program*

CONSERVATION AND ENVIRONMENTAL STUDIES CENTER, INC.

120-13 Whitesbog Road

Browns Mills, New Jersey 08015

Produced by a grant from Burlington County CETA

2311 Burlington - Mt. Holly Road

Burlington, New Jersey 08016

INFORMATION JUST FOR YOU

WHY TEACH ABOUT SOLID WASTES?

The specter of hazardous wastes frightens every community. We are all having more and more trouble throwing things away. Each year there is actually more to put in the waste can; and each year there seems to be less space available for disposal. Surprising amounts of energy are spent or lost with our present means of getting rid of wastes. The disposal of solid wastes is the hottest environmental problem today.

Here are some reasons why you might want to share some learning experiences about trash and garbage with your kids.

Landfills are closing up; we're running out of landfill space.

Trash/garbage collection costs more and more, taking an increasingly larger tax bite.

Hazardous wastes are the focus of the latest scam by organized crime

Everybody comes in contact with solid wastes daily.

There are excellent opportunities for drills with basic skills:

mathematics - measurement, drill and data interpretation

group leadership and interaction

language arts - spelling, writing,reports, giving oral reports to peers and adults, letter writing, vocabulary and using library and other research techniques.

art - murals, posters, sketches, plays, skits, songs

values consideration - exploring the values of self and others

HOW TO USE THE CESC/CETA SOLID WASTE CURRICULUM SPECIAL FEATURES

You may be weary of seeing new curriculums and even when you like them, wonder how you could possibly add anything more. Here's the good news about this curriculum:

You may plagiarize. You may save paper and money by photocopying any or all activities as you please.

It's designed as a take-it-or-leave-it curriculum. You may use as few as one lesson/activity or as many as you like. It's open ended.

It is multi-disciplinary, can be related to various studies; it's interdisciplinary in many activities; the subject matter boundaries are broken down.

You may conduct field trips at your own school or your community,

WHAT ABOUT ? ? ?

The Big Ideas

The prime learning objectives are prominently displayed as "The Big Ideas." If you would like your students to develop these generalizations on their own (by induction), you may block out the "Big Ideas" so that they won't appear in the photocopies.

Evaluation

One successful kind of evaluation is that in which the teachers are satisfied that objectives have been achieved. Each objective is keyed to one or more activities which should, if successfully carried out, provide evidence for the achievement of an objective. The many products of these activities, data pages, oral and written reports, drawings and murals are chief sources of evidence.

The section called "On Your Own" is not only intended to be a profitable set of follow up activities. These activities also lend themselves as an evaluation tool.

Answers To Questions and Numerical Problems

You will find answers for all questions on pages 3 or 4 of the unit folder which is your special unit teacher's guide.

Grade Level Placement/What Activities For What Grade Level?

If the activities included in any grade level cluster present a problem, you'll have to deal with it by agreement in any school or "district wide" as you choose. Certainly you will want to avoid the deadening effect of "we did this last year." You will probably want to divide the activities among or between the grades.

It seems best to leave the choice to you especially since with classes of younsters with varying abilities, interests, and curricular freedoms, you may even wish to utilize activities from a different grade level cluster.

INFORMATION JUST FOR YOU

GETTING ENERGY FROM TRASH AND GARBAGE

This information applies to

Grades 5-6, B-3 "Garbage to Soil", C-5 "Visiting a Recycling Center," D-5 "Trash Power," E-5 "Garbage Power." Grades 7, 8, and 9, D-4 "We Used Garbage For Energy."

--Part of the answer to America's power shortage may be found in a dump. This practice of getting energy from trash is rapidly becoming reality. Garbage and trash, especially the organic portion, will burn. Mixed municipal solid waste is mostly composed of combustible materials, i.e. paper, plastic. More than 90% of the volume of mixed municipal solid waste can be eliminated by incineration.

--In a total resource recovery operation everything going into the waste stream, whether organic or inorganic, would become a usable "product", such as fuel, fertiliser, steam, electricity, or other salable material. Both in this country and abroad, modern pollution-controlled incinerators are using garbage and trash to produce steam. When unseparated municipal refuse is burned heats about half as well as coal. This steam is then used either directly to provide building heat or indirectly to drive steam turbines that produce electricity. In addition to burning the organic part of refuse as a substitute for other fuels, garbage and trash can be converted into storable fuels.

--Instead of being burned, waste may also be placed in a closed chamber and baked at high temperatures in the absence of oxygen, thereby reducing the volume by about 90 percent. This form of incineration is known as "Pyrolysis", and may bring us even closer to a state of "zero waste growth.

--Besides being a source of heat and power, organic refuse has other uses. One of these other uses is composting. Composting utilizes both bacterial and chemical processes to convert organic wastes into soil conditioners that can enrich gardens and farmlands. It is one of the oldest and most familiar forms of resource recovery. Until recently, composting has been used mainly by home gardeners.

--Municipal composting is more common in Europe where there are few land sites for waste disposal. It was hoped that a profitable business of producing compost could be started in the United States Composting has not yet become well established in this country because there are many other sources of less expensive chemical fertilizers. The costs of separating and transporting compost to the point of use are high. However, we must also consider the benefits of composting in terms of health, cleanliness and resource conservation as well as the cost of alternative methods of disposal, before we dismiss composting as being uneconomical.

-With the demand for electric power increasing each decade, these ways to obtain heat and power from organic refuse are important additions to our energy that was required to take it away from the environment in the first place.

-To have value, materials must be recovered from refuse on a large scale basis. Before this can happen, answers must be found to the complex questions of costs, potential markets and public attitudes in order to develop a lasting solution. In the United States there is growing public concern about the problem of solid waste and a sincere desire to face the challenge.

LANDFILLING

This information applies to:

Grades 5-6, B-1 "Open Dumps and Sanitary Landfills," Grades 7,8,9 B-1 "Introducing the Sanitary Landfills."

Here is some pertinent information on landfills which you may find to be informative and helpful in assisting children to work on these activities.

-The landfilling of waste materials dates back to very early times. It is one of the oldest waste disposal techniques used by modern man, short of illegal or open dumping. It is still the least expensive waste disposal practice in current use.

-During the last four decades, solid waste disposal techniques in a landfill (or what used to be called a dump) have been greatly improved to minimize environmental damage, and is now termed "Sanitary Landfilling." It can be both environmentally sound and economically competitive. However, one of the important problems with landfill operations is the fact that so many are not managed efficiently or with maximum environmental safeguards.

-Sanitary landfilling is a process where refuse is spread, compacted and covered with soil in a prescribed manner to a depth of twenty-four or more inches. These techniques, when managed properly, minimize environmental degradation while trying to maximize the effective use of available land.

-When solid wastes are put into a landfill, degradation takes place as a result of various chemical and biological reactions. This degradation process produces solid, liquid and gaseous by-products The principal gases generated are carbon dioxide and methane.

-Carbon dioxide is water soluble and can be absorbed into the ground water. Upon entering the groundwater, carbon dioxide lowers the pH (or increases the acidity level), thereby magnifying its corrosiveness.

-Methane is relatively insoluble in water and, because of its lightness or low density, it will migrate

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vertically or laterally through the refuse into the atmosphere or surrounding areas. Methane gas is both explosive and toxic. It is toxic in the sense that anyone entering a room or chamber filled with methane would suffocate from a lack of oxygen.

–As rain water or ground water percolates through a landfill, it becomes contaminated with water soluble products from the solid wastes or their decomposition. This escaping water, with its additional dissolved or suspended matter is called leachate. It can migrate from a landfill and directly affect the quality of ground and /or surface water nearby.

–To maximize environmental protection, hydrological and geological investigations are necessary before the site of a sanitary landfill is chosen. These investigations will determine whether the earth at the site is compact enough to prevent the leachate from entering the ground water. A surface and ground water quality monitoring program in conjunction with an impervious substrate or foundation are management techniques and site qualities which a desirable potential landfill site should have. The following methods should also be utilized to maximize environmental protection A) leachate collection and testing B) capping with twenty-four inches of soil, C) methane gas control, and D) monitoring the drainage basins where leachate collects.

–The failure to adhere to these protective measures leads to the dangerous states of contamination which have recently been so alarming to the general public.

SOURCE SEPARATION AND RECYCLING

THE PROPOSED MULTI-MUNICIPAL SOURCE SEPARATION RECYCLING PROGRAM FOR BURLINGTON COUNTY

This information applies to:

Grades 3-4, B-2 "Recycling Relay Game," Grades 5-6, Unit C (all activities) Grades 7, 8, and 9; D-2 "What If We Source Separate?" D-3 "What If We Recycle Steel, Aluminum, and Glass?

The volume of municipal solid waste generated in New Jersey each day is of sufficient volume to fill Giants Stadium every two weeks.

As solid waste management problems have become increasingly evident, methods have been sought to mitigate the negative aspects of "garbage." Planners have sought to develop measures that would both lower the volumes of materials going to landfills, as well as put that particular material to a subsequent use. Recycling of material such as newspapers, glass and metals performs both of these functions.

Under New Jersey Public Law 1975, Chapter 326, entitled the New Jersey Solid Waste Management Act, each county and the Hackensack Meadowlands Development Commission were designated as solid waste management districts. Under the Act, each district is responsible for developing and implementing plans which provide for the "maximum practicable use of resource recovery strategies" (i.e., recycling).

The Burlington County Office of Waste Management Programs, situated within the County Health Department, has developed an implementation plan for a two-year pilot program in curbside collection of source separated newspaper. Source separation programs are a major component of the overall resource recovery strategy identified in the Burlington County District Solid Waste Management Plan, recently adopted by the Board of Chosen Freeholders. The source separation plan sets forth a comprehensive program whereby a private contractor will provide curbside collection of used newspaper on a bi-weekly basis throughout the Townships of Cinnaminson, Delran, Moorestown and Willingboro. The contractor will not be paid by the participating townships or the County for this service, but instead is expected to offset his capital and operating costs and receive a reasonable rate of return on his investment through revenues generated from the scale of the recovered newspapers.

Scout troops, charitable organizations, and individual scavengers will be able to continue their operations with only minor changes to their present collection methods. In fact, recent studies indicate that such groups thrive when coexisting with a formalized municipal program.

The proposed program is designed to be basically self-supporting (not requiring a subsidy through the use of tax-payers' money) and will provide a savings to the individual townships. These savings can appear as: 1) rebates from the newspaper collector based on tonnage of newspaper recovered. 2) Rebates from the mixed-refuse collection in townships with contracted garbage collection systems or in the case of townships with their own regular garbage collection systems direct cost savings are encountered through the decreased volume of waste physically collected by them. 3) Rebates from savings encountered by re-routing regular garbage collection vehicles in a more energy efficient manner by taking advantage of less regular waste found at each collection stop. 4) reduced disposal costs due to less material to be landfilled; and 5) conservation of scarce and costly landfill capacity. With each ton of newspaper recycled, three cubic yards of landfill space is conserved and seventeen trees from our valuable forest lands need not be cut down for their pulp value. In addition, 60% to 70% less energy is utilized in producing new pulp products from recycled paper, versus virgin wood pulp.

Oil is not the only imported material which is having an impact on the United States trade deficit and contributing to the current inflationary spiral. Numerous raw materials used in manufacturing processes are imported into the U.S. Many of these raw materials are presently in the municipal waste stream and could be recycled to produce an economically attractive domestic supply. New newsprint is one example. Implementation of newspaper source separation programs similar to the one proposed will help alleviate the U.S. dependence on imported newsprint. At the same time, this effort will also foster the strength and expansion of recycling industries which contribute significant primary manufacturing strength to the New Jersey economy through jobs and ratables. The proposed recycling program should afford the resident an opportunity to effectuate a change in historically wasteful and environmentally damaging solid waste management trends.

Present projections call for the initiation of the proposed source separation newspaper recycling program in April 1981.

* Adopted from the descriptive text developed by Burlington County Office of Solid Waste Management Program.

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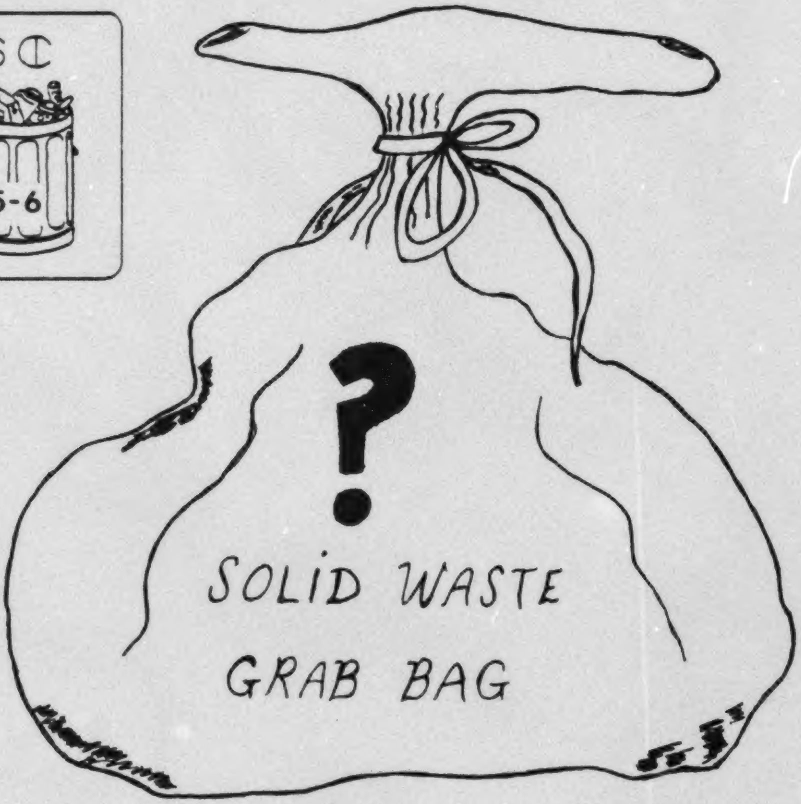
5-6



> *"Continue to contaminate your bed, and you will one night suffocate in your own waste ... this we know. The earth does not belong to man; man belongs to earth. This we know. All things are connected like the blood which unites one family. All things are connected."*
>
> *Chief Seattle; Leader of*
> *Suquamish Tribe*
> *Washington Territory 1854*

Everyone knows that solid wastes are an increasing problem of national scope. The increasing cost of disposal and the poisoning of air and water near solid waste sites are the two chief aspects of this problem. Another problem is that we are running out of space for the disposal of solid wastes. Clearly, societal changes are sorely needed. Education about the solid waste problem is the first step.

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING LESSONS:

A - 1 DISSECT A TRASHCAN

SKILLS: Reading comprehension, vocabulary, recording observations, research techniques, group cooperation, working independently.

PREPARATION: None

Solid wastes are composed of many different materials, some of which are more common than others. In this lesson the students will become aware of what solid wastes are. They will discover what the most common forms of solid wastes are by rummaging through trashcans and dumpsters.

A - 2 SOLID WASTES WERE ONCE PART OF THE EARTH

SKILLS: Reading comprehension, vocabulary, organizing information, library skills, recording information, sketching.

PREPARATION: Lesson A-1

Solid wastes were once useful objects which were produced from natural resources inside or at the surface of the earth. This lesson will examine the origins of solid waste materials. The students will trace examples of solid wastes back to the natural resources they were produced from (ex. paper towels → pine tree).

A - 3 WHO MAKES SOLID WASTES?

SKILLS: Reading comprehension, vocabulary, interviewing, research techniques, leadership abilities.

PREPARATION: None

Solid wastes are produced by everyone. They come from factories, stores, houses, farms, offices, and schools. The students will become aware of their own role in the solid waste problem. They will discover what types of wastes are produced by different people.

A - 4 LITTER AND LITTERBUGS

SKILLS: Reading comprehension, vocabulary, values clarification.

PREPARATION: None

The abundance of litter across the country is one sign of the solid waste problem. This lesson will provide the students with an opportunity to examine their feelings about litter and littering.

A - 5 OUCH!

SKILLS: Reading comprehension, vocabulary, oral reporting, working independently, values clarification.

PREPARATION: Ask each student to bring in a newspaper.

Large amounts of natural resources must be removed from the environment to replace products which have become solid waste. This lesson is concerned with environmental damage sometimes caused by the removal of these natural resources. Damages may include loss of vegetation, erosion, loss of wildlife habitat, water and air pollution and urban problems.

A - 6 HOW MUCH STUFF?

SKILLS: Reading comprehension, measurement, addition, subtraction, multiplication, division, problem solving, using tables, working independently.

PREPARATION: None

Because each of us produces several pounds of solid waste every day, the total amount of solid waste produced by each family in each community is very large. This lesson will focus on the amount of solid waste the students generate in their homes. They will calculate how long it would take to fill up their own backyards if they stopped having their garbage collected.

Each of these lessons can be completed in one 45 minute class period, but they can be expanded to 2 - 3 class periods depending on teacher discretion and class interest.

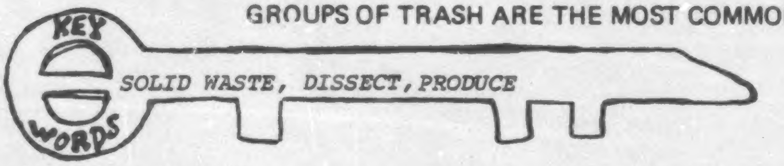
A1 DISSECT A TRASHCAN

MATERIALS: TRASHCAN
DUMPSTER
3 PAPER BAGS
2 CARDBOARD BOXES
2 NEWSPAPERS
2 PAIR RUBBER GLOVES

BIG IDEA:

Solid wastes are composed of many different materials. Some of these materials are found more often than others.

YOUR JOB IS: SEPARATE THE CONTENTS OF DIFFERENT KINDS OF TRASH CONTAINERS INTO GROUPS OF MATERIALS AND IDENTIFY WHICH GROUPS OF TRASH ARE THE MOST COMMON.



SOLID WASTE, DISSECT, PRODUCE

SOLID WASTE - *MATERIALS THAT HAVE BEEN USED AND THROWN AWAY; SOLID, NOT LIQUID OR GAS.*
DISSECT - *TO TAKE AN OBJECT APART PIECE BY PIECE IN ORDER TO LEARN ABOUT IT.*
PRODUCE - *TO MAKE OR MANUFACTURE; THEY PRODUCE PAPER AT THE PAPER MILL.*

BEGIN HERE:

Divide yourselves into 3 groups. Make sure that each group has a paper bag. Do not spend more than 20 minutes at your assigned dumping station. Return immediately to your classroom.

GROUP 1 LOCATION: CLASSROOM

1) Dump the contents of your classroom trashcan on the floor.
2) Put all of the materials with the same composition into piles.
3) Make a list on the blackboard of what you find with the amount of each type listed next to it.
4) Which group do you have the most of? Write it down.
5) Which group do you have the least of? Write it down.
6) Make a list on the board of other places besides schools where people throw things away; such as homes, stores, offices, restaurants, etc. Do these places produce solid wastes that are different from what you found? How do you know?
7) Take one sample of each kind of solid waste you found and put them in the paper bag to show the class.
8) Pick out one person to show and tell the class what your group found.

GROUP 2 LOCATION: CAFETERIA

Need 2 newspapers, one person with paper and pencil and 1 pair of rubber gloves.

1) Ask the cafeteria staff to let you look through one of the school cafeteria garbage cans.
2) Spread the newspapers on the floor and dump the contents of the garbage can onto the newspapers. Use the rubber gloves to sift through the waste.
3) Put all of the materials with the same composition into piles.
4) Make a list on paper of what you find and write down the amounts too!

OVER

5) What do you find the most of? Write it down.
6) What do you find the least of? Write it down.
7) Take one sample of each kind of solid waste you found and put them in the paper bag to show the class. Put the rest back in the can. Be sure to leave the floor clean. If you don't know how, ask one of the cafeteria staff to show you. Pick out one spokesperson for the group.
8) Make a list of other places where things get thrown away; such as homes, stores, offices, restaurants, etc. Are their garbage cans filled with anything different from what you found? How do you know?

GROUP 3 LOCATION: SCHOOL DUMPSTER

Need 2 cardboard boxes, 1 person with paper and pencil and 1 pair of rubber gloves.

1) Take as much material as you can out of the dumpster and put it into one of the cardboard boxes.
2) Group all materials with the same composition into piles.
3) Make a list on paper of all of the materials you find with the amounts of each next to them.
4) Write down what you find most of and least of.
5) Put one sample of everything you find into the paper bag to show the class.
6) Make a list of other places where things get thrown away, such as homes, stores, offices, etc.
7) Are their garbage cans filled with anything different from what you found? How do you know?
8) Pick out one person to show and tell the class what your group found.

ALL GROUPS TOGETHER:

1) Have the spokesperson for each group get up one at a time and report the group findings.
2) Discuss the following questions with the class;
    a) What were the 3 most common materials you found? List them.
    b) Are the contents of all trash containers alike? If no, list how and why they may be different.
3) Save all of your solid waste samples for the next lesson. If any of your solid waste bags have an odor, use twist ties, double bag, and keep refrigerated.

CAN YOU DO THESE?

1) Think of some other materials people throw away that you didn't find today.
2) Think of ways you could reuse some of the solid waste samples you found today.

ON YOUR OWN:

1) Dissect your own trashcan at home.
2) If you want to find out how much money you can make by recycling your trash, ask your teacher to let you do lesson E4.

IMPORTANT:

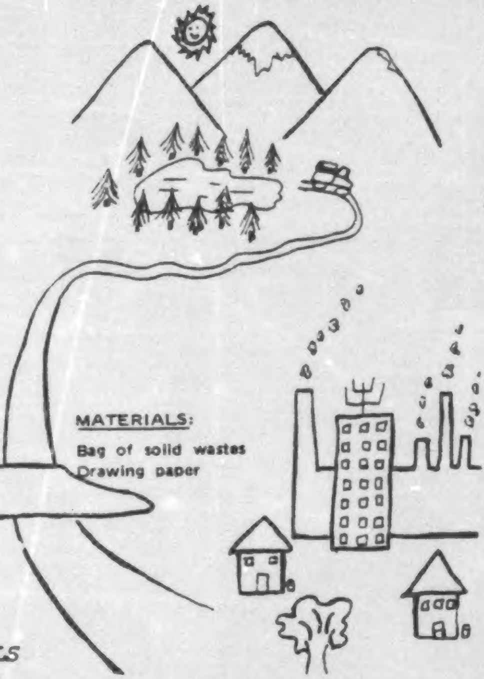
Save your solid waste materials for the next Activity, A-2.

A 2 SOLID WASTES WERE ONCE PART OF THE EARTH

BIG IDEA:

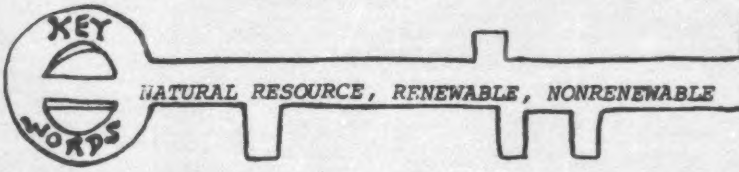
Solid wastes were once useful objects. They were produced from natural resources inside or at the surface of the earth.

YOUR JOB IS: TAKE 3 EXAMPLES OF SOLID WASTE AND FIGURE OUT WHICH NATURAL RESOURCES THEY WERE PRODUCED FROM.



MATERIALS:

Bag of solid wastes
Drawing paper



NATURAL RESOURCE, RENEWABLE, NONRENEWABLE

NATURAL RESOURCE - MATERIALS PEOPLE USE TO MAKE USEFUL OBJECTS OR PROVIDE ENERGY. THESE MATERIALS ARE FOUND IN OR ON THE EARTH.

RENEWABLE MATERIALS- CAN BE GROWN OR USED AGAIN AND AGAIN; EXAMPLES ARE TREES, PLANTS AND ANIMALS.

NONRENEWABLE MATERIALS- CAN ONLY BE USED OR PRODUCED ONCE; EXAMPLES ARE OIL, METALS, AND NATURAL GAS.

BEGIN HERE:

Take the samples of solid waste you collected during the first task and separate them into piles of glass, paper, metal, wood, plastic and organic material.

Each of you should pick 3 different samples. Make sure every pile is represented. For each sample of solid waste:

1) Draw a sketch of it.
2) If you know what it was before it was thrown away, draw a sketch of what it used to be.
3) What was it used for?
4) What natural resource was it made from?
5) Write down your answers to the above questions in this table.

TABLE 1

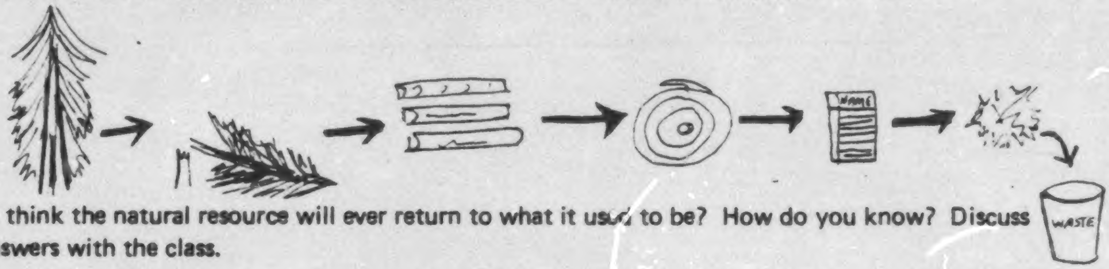
	What is it now ?	What did it come from?	What was it used for ?	What will it become ?	Renewable or Nonrenewable
1					
2					
3					

If you can't fill this in on your own, ask your teacher for help.
You can check the encyclopedia for information on making glass, metal, paper, etc.

OVER

NEXT:

Pick one of your solid waste samples and draw a pictorial life history of it like the one below:



Do you think the natural resource will ever return to what it used to be? How do you know? Discuss your answers with the class.

Draw sketches of the natural resource(s) you like the most. Explain why to the class in a show and tell.

1. Will these natural resources always be there for you to enjoy? How do you know?
2. If not, where will they go?

CAN YOU DO THESE?

1. Are there any objects you know of that are not made from natural resources?

2. Think of ways you can help to save our natural resources for the future. Discuss these with your friends.

3. Do you think people should use renewable or nonrenewable natural resources? Why or why not?

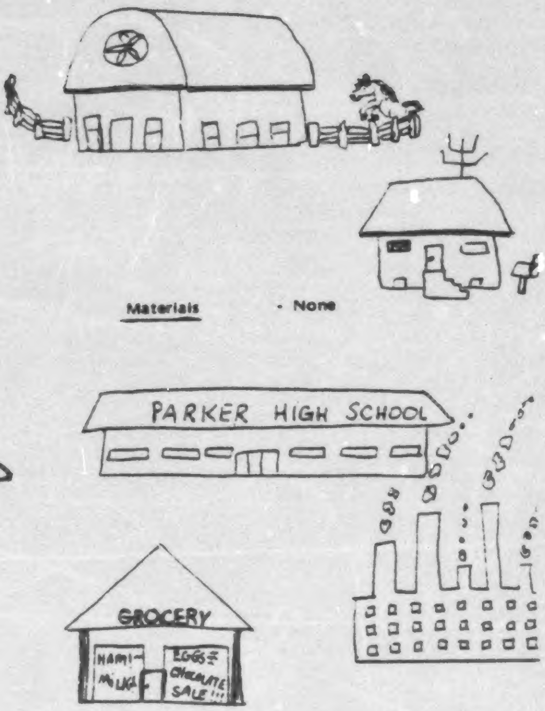
ON YOUR OWN:

1. Draw a pictorial life history like the one above about your favorite object (skateboard, bicycle, record player, etc. . .)
2. When you are throwing something away - - - ask yourself:

   "What natural resource (s) am I throwing away?" Is it renewable or not?
   "Can I use it again for something else?"
   "Where will it go after I throw it away?"

3. If your are interested in what happens to the earth when natural resources are removed from it, ask your teacher to let you do lesson A 5.

A 3 WHO MAKES SOLID WASTES?

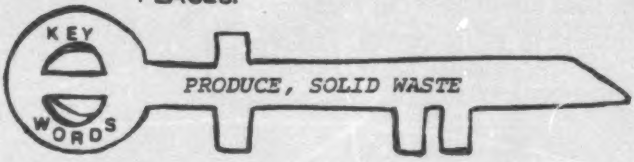


Materials - None

BIG IDEA:

Solid wastes are produced by everyone. They come from factories, stores, houses, farms, offices, and schools.

YOUR JOB IS: DECIDE WHAT KINDS OF
SOLID WASTE ARE PRODUCED
BY DIFFERENT PEOPLE AND
PLACES.



PRODUCE - TO MAKE OR MANUFACTURE.
SOLID WASTE - MATERIALS THAT HAVE BEEN USED AND THROWN AWAY; SOLID, NOT LIQUID OR GAS.

BEGIN HERE:

1) Choose 8 students out of your class to role-play this activity. Assign 6 of the students to role-play the professions listed in the table below.
2) Ask them to think about what they would throw away if they were that person.
3) Tell them that 2 interviewers from WASTE TV will be coming soon to interview them about their garbage. The remaining 2 students, working together, will be the TV interviewers.
4) The TV interviewers should record all of the responses to the questions in the following table:

TABLE 1

	1 GROCER	2 FARMER	3 CAR MECHANIC	4 HOUSEWIFE	5 RESTAURANT CHEF	6 OFFICE CLERK	YOU
1							
2							
3							
4							
5							
6							
7							

OVER

The interviewers should ask each person the following questions. The class should suggest extra questions for the interviewers to ask.

1) How many pounds of solid waste do you think you produce each day?

2) Write down all of the kinds of solid waste you produce.

3) What kind of solid waste do you produce the most of?

4) Why does a person in your work or profession produce wastes?

5) What percent of this waste is necessary? What percent of this waste is unnecessary?

6) Do you think anyone you know might be able to use what you throw away? What is it and how will people use it?

7) Use a question suggested by the class.

When the interviewing is over, the remainder of the class should fill in the last column "YOU". Ask yourselves the same questions asked by the interviewers from WASTE TV. Discuss your answers with the class.

CAN YOU DO THESE?

1) Out of the 6 people interviewed today, which one do you think might produce the most solid waste? How do you know?

2) Which one had the best chance of re-using his/her solid wastes? How do you know?

3) Think of people in other countries who might throw away materials.
Do you think they throw away the same things you do? Would they use the materials that you throw out ? How do you know?

ON YOUR OWN:

1) Visit your town dump. What solid waste do you see? Figure out who put it there.

2) The Environmental Action Coalition has a newsletter on environmental subjects. You can send for it and other information on solid wastes by writing to:

ECO-NEWS
Environmental Action Coalition
156 Fifth Avenue
New York City, N.Y. 10010

3) Imagine what your life would be like if you couldn't throw out any solid waste. What would you do?

A4

LITTER AND LITTERBUGS

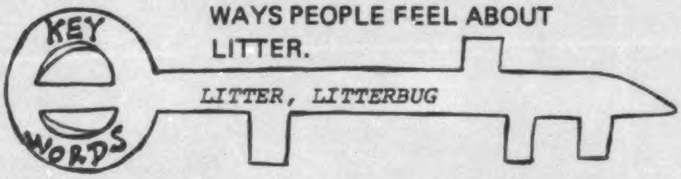
BIG IDEAS:

One obvious sign of the solid waste problem is the abundance of litter across the land.

Everyone has been a litterbug at least once.

YOUR JOB IS: TALK ABOUT THE DIFFERENT WAYS PEOPLE FEEL ABOUT LITTER.

MATERIALS: None



LITTER, LITTERBUG

LITTER ***- THINGS LYING ABOUT, SOLID WASTE SCATTERED ON THE GROUND.***
LITTERBUG ***- PERSON WHO THROWS SOLID WASTE ON THE GROUND, NOT IN A PROPER CONTAINER.***

BEGIN HERE:

Divide yourselves up into 3 groups and move to separate corners of the room. Read the following paragraph:

> *"You and your family are driving to the beach. Since it's 12:30 and you are hungry, you stop at a roadside picnic table to eat. Before sitting down you must move aside litter that somebody left. Luckily the trash can is empty so you have a place to put it all. Under the table on the ground are old cans, paper bags, plastic spoons, tin foil wrappers and chicken bones.*

Circle the word(s) below that best fit how you would feel if you were part of the story.

relieved
happy
disappointed
disgusted
mad
confused
worried
sad
frustrated
tired
hungry
sick
OK
resigned
don't care
not hungry

Why do you feel this way? Discuss your feelings with your group.

What would you do?

a. Pick up all of the litter, put it in the can and eat.
b. Move aside some of the litter so you can sit down to eat , then leave your trash on the table too.
c. Nothing, eat there anyway.
d. Sit over on the grass or someplace else and eat.
e. Leave without eating.
f. Other - fill in yourself.

OVER

NEXT:

1) Select a reaction which you agree with most. If you can't find one that fits how you feel, make up a new one.
2) Ask one or two people to explain to the class why they feel the way they do.

3) Write your own ending to the story.

4) Find out if anyone has changed his or her point of view. Why?

5) List at least two times that you littered.

ON YOUR OWN:

1) Try this story on your family!

2) If you want to find out how much we pay to clean up litter, ask your teacher to let you do lesson E 2 next.

3) New Jersey is involved in an anti-litter campaign; to find out information about it and how you can help write to:

Governor's Anti-Litter Campaign
Governor's Office of Policy and Planning
Office of the Governor
Trenton, New Jersey 08625

4) Have you ever found litter in the movie theater? School cafeteria? On the street by your house? At a football game? On the bus? What did you do? How did you feel?

5) If litter was worth money, would people act differently towards it? Why or why not?

A 5

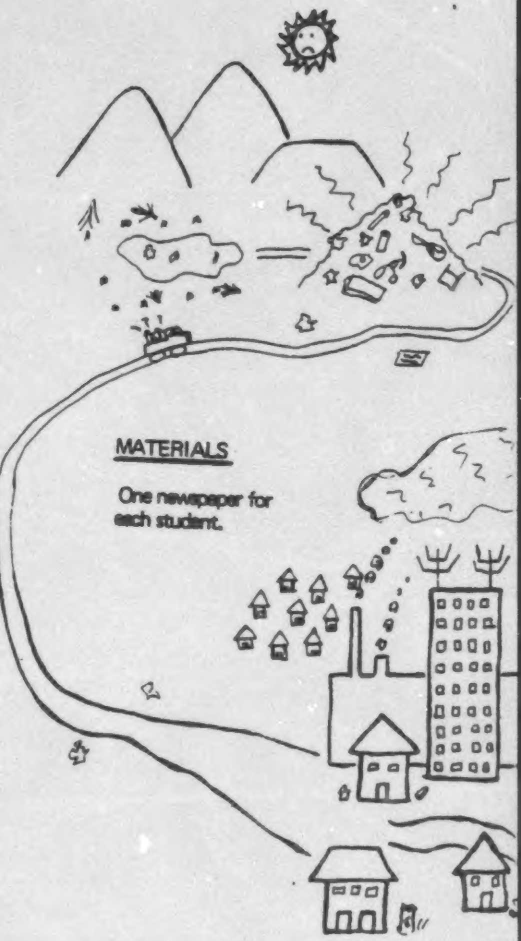
"OUCH!"

BIG IDEAS:

A large amount of the natural resources we take out of the environment are used to replace products which have since become solid waste.

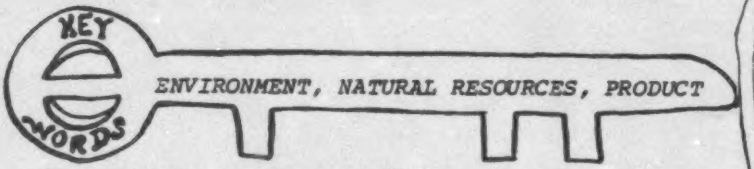
The removal of these natural resources can sometimes cause a great deal of damage to the environment.

YOUR JOB IS: FIND OUT HOW THE REMOVAL OF NATURAL RESOURCES CAN SOMETIMES DAMAGE THE ENVIRONMENT.



MATERIALS

One newspaper for each student.



ENVIRONMENT, NATURAL RESOURCES, PRODUCT

ENVIRONMENT - A COLLECTION OF THINGS WHICH SURROUND PLANTS AND ANIMALS, INCLUDING OBJECTS, INFLUENCES AND SITUATIONS.
NATURAL RESOURCES - MATERIALS PEOPLE USE TO MAKE USEFUL OBJECTS OR PROVIDE ENERGY. THESE MATERIALS ARE FOUND IN OR ON THE EARTH.
PRODUCT - OBJECT WHICH WAS MADE FROM ONE OR MORE OTHER MATERIALS.

BEGIN HERE:

Divide your class into two groups - A & B. Each group will hear a different version of the same story. Ask your teacher to tell one person in each group one of the story versions. This student should tell it to another student secretly. That student should tell it secretly to another until everyone has heard a version of the story in secret.

1. Ask the student who heard the story last in group A to tell it aloud to the class.
2. Ask your teacher to tell his/her version of the story.
3. Ask the student who heard the story last in Group B to tell it aloud to the class.
4. Are the 2 stories different? Are they different from what you heard?
5. How did the stories become different?

This might help to explain how people get so many mixed up ideas about solid waste and its importance. Do you know any stories like this one? If so; where did you hear them?
Do you know what the word environment means? See if you can change the definition above into your own words. List at least three examples of the word environment.

NEXT:

1. Take out the newspapers your teacher asked you to bring to class.

OVER

2. Cut out every article you can find that talks about solid waste problems, natural resources and the environment.

3. Pick one and write down the name of the article and a short description in your own words of what it was about.

IN YOUR ARTICLE:

1. Was the environment changed? If yes, how?
2. Was it damaged? If yes, how?
3. What natural resources were involved?

CAN YOU DO THESE?

What natural resources were removed to produce the newspaper you just read?

Did the removal of that natural resource damage the environment?

How do you know?

When you throw away an aluminum can how do you change the environment?

ON YOUR OWN:

1. Become aware of the natural resources around you.

2. List the ones you can find in your own yard.

3. Think about what would happen to your yard if they were removed (Don't forget air and water!)

4. If you want to find out about the damages solid waste disposal causes to the environment, ask your teacher to let you do Unit B.

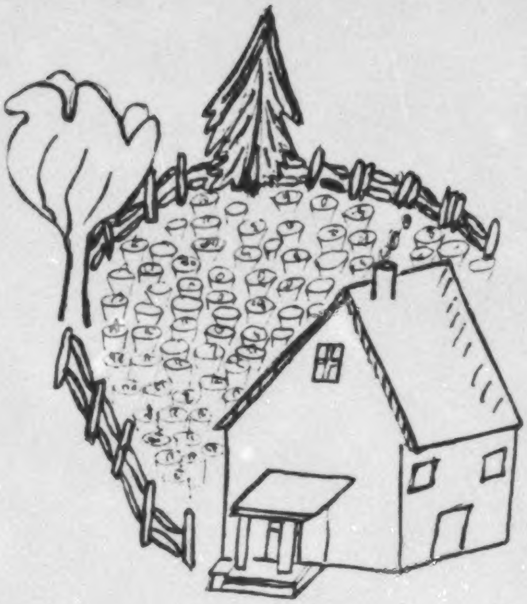
5. Keep up to date with local newspapers and magazines to find out more about the environment.

A6

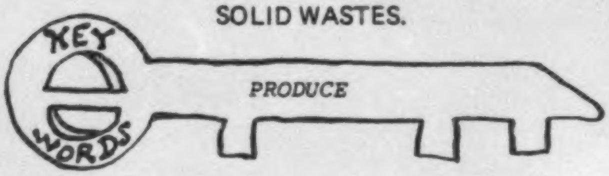
HOW MUCH?

BIG IDEA:

Each of us produces several pounds of solid waste every day. The total amount of solid wastes produced by each family in each community is very large.



YOUR JOB IS: FIGURE OUT HOW MUCH TIME IT WILL TAKE TO FILL YOUR BACKYARD WITH YOUR FAMILY'S SOLID WASTES.



PRODUCE - TO MAKE OR MANUFACTURE.

MATERIALS: None

BEGIN HERE:

Imagine that your backyard is filled up with trashcans.

If the cans are crowded together as closely as possible you could squeeze 40 cans in one row along the length of 100 ft. yard. If the yard measures 100 ft. long and 100 ft. wide multiply 40 X 40 = 1,600. That's 1,600 trashcans!

Use Table 1 below to estimate how many trashcans fit into your own backyard. Use Table 2 on the back to record your data.

EXAMPLE: If a yard measures 50 ft. in length and 20 ft. in width, how many trashcans can it hold?

Step 1: Find 50 ft. and 20 ft. in column one.

Step 2: Find how many trashcans will fit along 50 ft. and 20 ft. in column 2

TABLE 1
Backyard distances and trashcan numbers

COLUMN ONE DISTANCE IN FEET	COLUMN TWO TRASHCANS/DISTANCE
10	4
20	8
30	12
40	16
50	20
60	24
70	28
80	32
90	36
100	40
110	44
120	48
130	52
140	56
150	60
160	64

FEET	TRASH CANS
COLUMN 1	COLUMN 2
20	8
50	20

Answer: 8 cans will fit along 20 ft.
20 cans will fit along 50ft.

Step 3: Multiply 8 cans times 20 cans.
8 cans X 20 cans = 160 cans

Answer: 160 trashcans will fit in the yard.

Step 4: Now figure out how many trashcan loads of solid waste your family throws out every week. Make sure you are counting the cans the trash collector picks up and not the smaller cans inside of your house.

Example: If your family of 4 throws out 4 trashcan loads each week and it takes 160 trashcans to fill up your yard:

160 ÷ 4 = 40 weeks
40 ÷ 4 = 10 months
10 ÷ 12 = 0.8 years

TABLE 2: YOUR DATA

Yard length	Number cans	Yard width	Number cans	TOTAL Number cans

1) Number of cans needed to fill your yard ____________________
2) Number of cans per week thrown away ____________________
3) Time needed to fill your backyard with cans ____________________

Depending on the size of your yard and your family, it will take from 1 week to 10 years to fill it up with trash cans. An average time of 2-3 years may seem like a long time to you now. Try to imagine where your trash will go when you are in the 7th or 8th grade and your backyard is filled up!

CAN YOU DO THESE?

1) Do you think your trash takes up the same amount of room in a public landfill?
2) How long do you think we have before our landfill space runs out?
3) Find out the "life expectancy" of the landfill nearest to your home.
4) Do the entire lesson again with the metric system.

ON YOUR OWN:

1) Think of ways to cut down on the amount of trash you throw out each week.
2) Think of the earth as your own backyard each time you put your trash out to be collected.
3) If you want to find out how much it would cost you to move your trash, ask your teacher to let you do lesson E1.
4) If you want to find out more about where your trash goes when it is collected, see Lesson B1 on landfills.

A WHAT DO WE THROW AWAY?

AFTER CARRYING OUT THE 6 TASKS IN THIS SOLID WASTE GRAB BAG UNIT, THE STUDENTS WILL BE ABLE TO:

	Tasks which meet these objectives
1. Collect and identify samples of at least 3 types of solid waste.	1
2. Separate samples of solid wastes into groups according to their composition.	1
3. Identify which natural resource the solid waste comes from by drawing a pictorial life history.	2
4. Identify who produces solid wastes and which types of solid waste different people make.	3
5. Identify and discuss feelings and ideas about litter and littering.	4
6. Define and give examples of the word "environment".	5
7. Identify environmental damages incurred by the removal of natural resources to replace goods which are now solid wastes.	5
8. Develop an awareness of the amount of solid waste produced by the student's own family.	6

GLOSSARY

SOLID WASTE--Materials, solid in composition, which have been used and thrown away.

TRASH-- Something worn out, broken up, or worthless.

LITTER-Objects lying about; scattered rubbish.

GARBAGE--Animal or vegetable matter which has been discarded.

NATURAL RESOURCE--Materials people take out of the earth to make useful objects or to provide energy.

ORGANIC MATERIAL-- Matter which can be broken down by organisms found in nature, such as bacteria.

ENVIRONMENT--A collection of items which surround a plant or animal; including objects, influences and situations.

INORGANIC MATERIAL- Matter that cannot be broken down or decomposed by organisms found in nature.

TEACHER GUIDE

A1 DISSECT A TRASHCAN

About 50% of all solid waste is paper. The other 50% includes metal, glass, textiles, plastics, and food wastes. These percentages will vary according to the sources of the solid waste. For example, offices and schools generate more paper than gas stations or restaurants.

A2 SOLID WASTES WERE ONCE PART OF THE EARTH

All products we use and throw away were made from natural resources. There is nothing produced today which does not ultimately originate from a natural resource. Examples of products made from natural resources are glass from sand, paper from trees, steel from ore, and plastic from petroleum.

OVER

TEACHER'S GUIDE (continued)

A5 Below are three sets of stories to use in the activity. Each story has two versions; an environmental version and a business version. Use the set of stories which is most suitable to your students own environment. Tell one half of the class the environmental side of the story and let them pass it among themselves. Do the same with the business side of the story.

1a One day while riding with my grandfather we passed a large abandoned house. Next to it was a very still and quiet lake. Everywhere I saw large holes dug in the ground and old rotting tree trunks. The place reminded me of a scene from a horror movie. My grandfather told me when he was a young boy he used to go sailing and fishing on the lake all day long. He used to hunt rabbits and deer in the woods that surround the lake. I found that hard to believe. He told me a gravel company bought the land about 40 years ago. They cut down the trees to make roads for their trucks and they drove steam shovels in to dig out the gravel. They dug big holes in the earth. Rabbits, deer and birds fled their homes. The gravel company dumped chemicals and rocks in the lake. The fish and plants died. When the gravel was all gone the company boarded up the office building and left. Nothing has grown or lived on the land since.

1b Dear Citizens:

I represent the Stoney Gravel Company. We have just bought the rights from your town council to dig for gravel on the west side of town by the lake. This gravel will be used for the construction of highrise apartment buildings. The project is important to our company and to you as well. The population of your town is increasing at an alarming rate each year. Highrise apartment buildings are the answer to the housing problem. New jobs will be opening for the people of your town and the taxes our company pays will increase your town's treasury. We are sure that this will be a profitable operation for everyone.

Thank you very much,

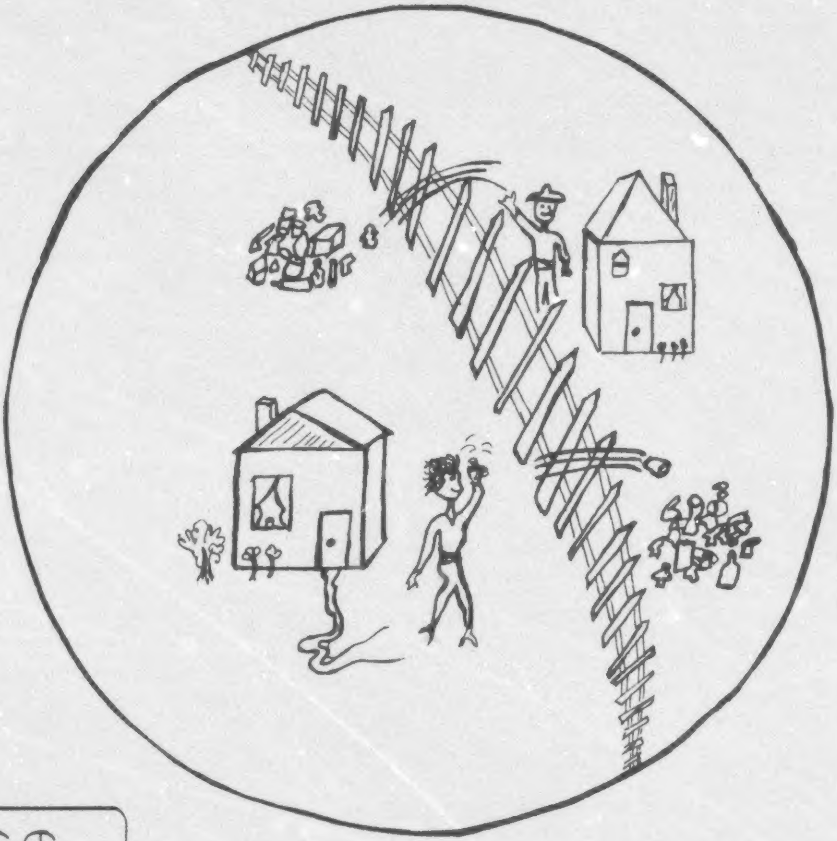
Mr. S. Gravel

2a The power company, Moore Electric, discovered a large pocket of natural gas 300 miles off of the coast. The power company said that drilling for gas so far from the shore could not harm the environment. Two years after drilling started 3 large fish kills occurred. No fish kills had ever been reported before this time. It was clear that a leakage of natural gas into the water had caused the fish to die. However, the power company denied killing the fish. They claimed that a connection between the fish kills and the gas wells could not be proven. None of the contaminated fish have reached shore. The Ocean Protection Agency feared that birds and larger fish that eat the contaminated fish would also be affected. They say there is a chance that the contaminated fish might reach the supermarkets.

2b The Moore Electric Comapny announced today that they believe there are many large pockets of natural gas 300 miles off of the coast. Drilling operations will begin this week. Company officials said,"This will be the first important step to make our country independent of foreign energy supplies." They went on to say, "Our original well only produces enough gas to heat one third of the state." They also said, "The new wells will triple the amount of gas we produce." Company officials feel these new wells will supply enough gas to heat the homes and offices of everyone in the state. Extra gas could be sold to neighboring states. Some of the money from the sale of extra gas will help senior citizens.

3a Once upon a time there was a beautiful mountain range that separated two countries called Fresh and Air. The people that lived in Fresh and Air were very healthy indeed.There were plenty of fruits and vegetables growing wild up and down both sides of the mountain. Game was plenty and the atmosphere was very relaxing. The people spent their days hunting and gathering fruits and vegetables. The people in Fresh and Air had everything but money. They were very curious. They had heard stories from other lands about strange foods, clothes, and houses. So they sold their land to the Black Lung Coal Company in the neighboring country of Dirt. The people of Fresh and Air soon came to realize how the country of Dirt got its name. The coal company from Dirt tore down trees, ripped up wild vegetable patches, dug holes all over the mountains and polluted the air. The coal from Fresh and Air supplied electricity to homes in Dirt. Where once there was no need for a hospital, hospitals were built to heal the injured and sick coal miners. It was true that the people of Fresh and Air had money for fancy clothes, cars, and houses. But they were very sad people indeed.

3b This story will tell how the country called Dirt became the country called Clean. The Black Lung Coal Company from Dirt needed a new source of coal. They had dug out all of the coal they could find in Dirt. They bought a mountain range between the countries of Fresh and Air. To the coal company's surprise they found more coal in this new mountain range than they could ever use. They needed three times as many workers at the new mine than they used for the old mine. Most of the new workers came from Dirt. They made millions of dollars in the new mine. The workers from Dirt wanted entertainment to spend their new money on. They built movie houses, discos, bowling alleys, and race tracks. Tourists came from other countries to visit Dirt. The people from Dirt decided to make their town look better. They wanted to impress the tourists. The King of Dirt demanded that every building be painted. Trees and shrubs were planted. Dirt became clean and pretty. The people felt they needed a better name for their country. They had a contest to pick the best name. "Clean," was the favorite choice.



CESC
CETA
5-6

"Like the great apes, primitive man was wasteful and careless of his wastes, and he has remained so throughout history."

Rene Dubos
Professor of Environmental
Biomedicine
Rockefeller University

In disposing of solid wastes, man's disregard for the environment has led to its destruction in many instances. There are various methods of solid waste disposal that a community can choose based on economic, aesthetic and health factors. These current disposal methods are not adequate for our future needs. To be effective and efficient in disposing of solid wastes, a new multi-faceted and flexible approach is needed.

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING LESSONS:

B - 1 OPEN DUMPS AND SANITARY LANDFILLS

SKILLS: Reading comprehension, vocabulary, recording observations, research techniques, library skills.

PREPARATION: Contact county officials for permission.

Most of the solid wastes that we generate are disposed of by one of two methods; open dumping or sanitary landfilling. Open dumping is not only illegal but also presents health problems. This lesson will give the students an opportunity to research and investigate the local dump and/or sanitary landfill. The students will become aware of the problems associated with these two methods of solid waste disposal.

B - 2 GARBAGE TO ASHES

SKILLS: Reading comprehension, vocabulary, recording observations, research techniques, conducting experiments, group cooperation, measuring,ratios, addition.

PREPARATION: Collect materials in advance; bring in a briquet-fired portable grill.

Many communities incinerate their solid wastes. This reduces the amount of waste that must be disposed of by 80% to 90% in volume and 70% to 80% in weight. Air pollution and the disposal of the remaining ashes are two problems that are generally associated with this method. In this lesson the students will examine the process of incineration. To enhance their understanding, the students will construct a small scale incinerator.

B - 3 GARBAGE TO SOIL

SKILLS: Reading comprehension, vocabulary, group cooperation, leadership abilities, conducting experiments, recording observations.

PREPARATION: See materials

Composting is one method of solid waste disposal which makes use of our wastes in an environmentally safe manner. At present, the United States composts very little of its organic wastes. This lesson will demonstrate to the students how organic solid waste materials can be converted into useful, humus-like material through composting.

B - 4 TO SEA OR NOT TO SEA?

SKILLS: Reading comprehension, vocabulary, recording and organizing information, library skills, group cooperation, values clarification, conducting experiments.

PREPARATION: See materials

Some of our solid wastes such as sewage, sludge, and trash are dumped into the ocean. This method of solid waste disposal has proven to be dangerous to aquatic life and to man. This lesson examines the ocean's inability to accomodate the solid waste materials that are being dumped into it. The students will compare decomposition rates of a "wet" ocean environment to a "dry" land environment.

B - 5 CAUTION: AIR, SOIL, AND WATER AT STAKE!

SKILLS: Reading comprehension, vocabulary, organizing information, decision making, creative writing.

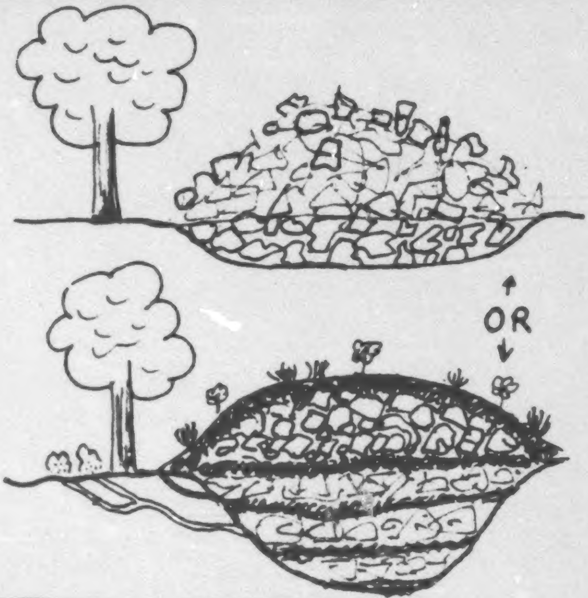
PREPARATION: None

All of the ways in which we dispose of our solid wastes result in a change in the air, soil, and water that surround us. Many methods of solid waste disposal have polluted the environment in the past and present. This lesson will give the students a chance to develop their own family solid waste disposal plan.

Each of these activities may be set up in one 30 - 50 minute period. Some of the activities, however, may require 4 to 8 weeks for the final results.

B1

"OPEN DUMPS AND SANITARY LANDFILLS"



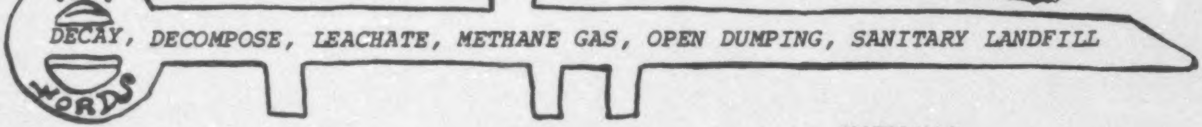
BIG IDEAS:

Most of the solid wastes that we generate are disposed of by one of these two methods; OPEN DUMPING or SANITARY LANDFILLING.

These methods can often lead to health hazards as a result of soil, water and air pollution.

Both of these methods are becoming more expensive due to increasing costs of open land.

YOUR JOB IS: TAKE A TRIP TO THE NEAREST DUMPING SITE.



DECAY, DECOMPOSE, LEACHATE, METHANE GAS, OPEN DUMPING, SANITARY LANDFILL

MATERIALS

See other side

DECAY - *TO ROT OR DECOMPOSE.*
DECOMPOSE - *TO SEPARATE INTO SIMPLE COMPOUNDS, SUBSTANCES OR ELEMENTS.*
LEACHATE - *RAIN WATER OR LIQUID THAT HAS PERCOLATED THROUGH SOLID WASTE AND HAS EXTRACTED POSSIBLY POISONOUS DISSOLVED OR SUSPENDED MATERIALS FROM IT.*
METHANE GAS - *A HIGHLY FLAMMABLE AND EXPLOSIVE GAS, BOTH ODORLESS AND COLORLESS, PRODUCED BY DECOMPOSING GARBAGE OR OTHER ORGANIC MATERIAL.*
OPEN DUMPING - *DUMPING TRASH INTO AN OPEN AREA IN AN ENVIRONMENTALLY UNSAFE MANNER.*
SANITARY LANDFILL - *A SITE FOR SOLID WASTE DISPOSAL WHICH USES THE TECHNIQUE OF SPREADING, COMPACTING, AND COVERING THE WASTE DAILY WITH A THIN LAYER OF SOIL TO INHIBIT ODORS AND SURFACE DECOMPOSITION.*

BEGIN HERE: As a class . . .

Ask your teacher to contact local or county officials for permission to visit the dumping site closest to you. If you are asked to write a report, the answers to the following questions will be helpful. Ask the landfill operator or the tour guide if you are not sure of the answer.

*Safety tip - Dumping areas can be extremely dangerous - be sure to follow all safety precautions while visiting the site. If the class cannot enter the landfill, or if it seems too dangerous, students may observe at a distance using binoculars.

1. Is the site that you visited an open dump or a sanitary landfill?
2. What is the distance from the site to the closest town or urban area?
3. What did the site look like before it was used for dumping?
4. How much time does this landfill have before it is completely filled?
5. What will the area look like when it is completely filled?
6. What will the area be used for once it is filled?
7. Can you see or smell methane gas from the landfill? Are there methane gas test pipes in the landfill? What are some possible uses for this gas?
8. Where does the leachate go? Is it collected?
9. Can you find items in the landfill that could be reused or recycled for a profit?

OVER

TRY THIS:

You can make your own miniature landfill and watch what happens to the solid wastes when they are buried under the ground. These are the materials you will need :

1. One (1) transparent tall glass or plastic container
2. Soil (dark garden soil works best)
3. Waste - ordinary kitchen and classroom garbage i.e. potato skins, banana peels, paper scraps,etc. . .

Bury pieces of the garbage in the soil at different depths in the glass, up against the inner surface, so you can see the pieces of garbage through the glass (see picture at bottom).

1. Leave an inch of air space over the FIRMLY packed soil.
2. Sprinkle occasionally with water to keep the soil moist but not puddled.
3. Record what changes take place in the different samples of garbage as they decompose.

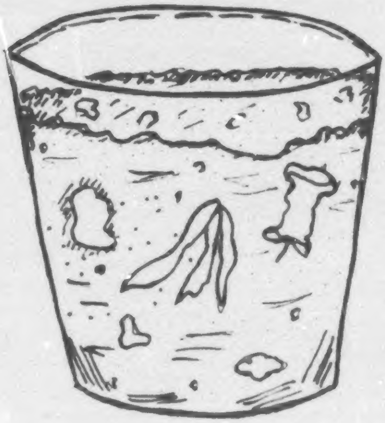
CAN YOU DO THESE?

After a few days decomposition should take place. You may begin to notice empty spaces where bits of garbage once were. Answer the following questions.

1. How do you explain these empty looking spaces? (Hint: see the key word "decay").
2. Does this same thing happen in real landfills?
3. If houses are built on these landfills after they are filled, what problems might the home owners have?
4. What could a landfill be used for once it is filled with garbage and covered over with soil?

ON YOUR OWN:

LOOK IT UP - For further information on this topic, ask your school librarian to help you locate materials in the "Readers Guide to Periodical Literature" on the subjects of "Open Dumping" and "Sanitary Landfilling".



B2

" GARBAGE TO ASHES"

BIG IDEAS:

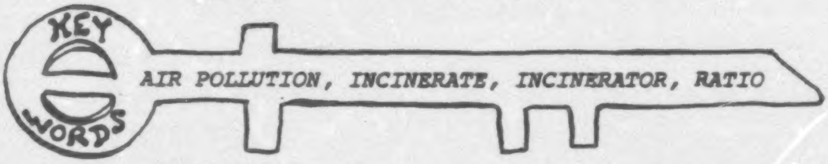
Many communities burn or incinerate their solid wastes in large, controlled burning facilities called incinerators. This reduces the amount of solid waste that must be disposed of.

Air pollution and the disposal of the remaining ashes are two problems that are associated with the incineration of solid waste.

YOUR JOB IS: FIND OUT WHAT HAPPENS TO SOLID WASTE DURING A PRIMATIVE PROCESS OF INCINERATION.

MATERIALS:

- 1 Hammer and nails
- 1 Bar-B-Que Grill
- 1 16 oz. can
- 3 Paper milk cartons
- 1 Scale
- 1 Pair of tongs



AIR POLLUTION, INCINERATE, INCINERATOR, RATIO

__AIR POLLUTION__ - CONTAMINATION OF THE AIR BY ANYTHING THAT MAKES IT LESS CLEAN OR PURE, SUCH AS SMOKE PARTICLES, OR POISONOUS GASES SUCH AS CARBON MONOXIDE OR SULPHUR DIOXIDE.

__INCINERATE__ - TO BURN; REDUCE TO ASH.

__INCINERATOR__ - A FURNACE FOR BURNING WASTE SUBSTANCES SUCH AS TRASH.

__RATIO__ - RELATION OF NUMBER BETWEEN TWO SIMILAR THINGS; A FRACTION.

BEGIN HERE:

The class may wish to divide into small groups. Be sure this activity is done OUTSIDE under your teacher's supervision. Maybe you can get a parent with a Bar-B-Que grill to come in and help the class. Shredded milk cartons from the cafeteria will act as our solid waste sample.

1. Puncture six (6) nail holes (evenly spaced) in the side of the can (near bottom or closed end).

2. Weigh and record the weight of the can (in grams) on the chart.

3. Measure and record the height of the can (in centimeters).

4. Shred the milk cartons into small pieces (be sure they are dry).

5. Fill the can COMPLETELY with the shredded waste (avoid overpacking, leave air pockets).

6. Weigh and record the TOTAL weight of the can and shredded waste. What does the waste weigh alone? (Hint: subtract the weight of the can from the total weight).

7. Place the can outside on the lighted Bar-B-Que grill (let the can and waste materials heat up for 10 minutes). Ask your teacher to set the waste paper on fire. Using the tongs to hold the match, place the lighted match into one of the nail holes in the can.

8. Allow the garbage to burn to a white ash. After the ashes are out and cold, CAREFULLY carry the can of ashes into the classroom for observation.

OVER

OBSERVATION:

1. What is the total weight of the can and ashes? What do the ashes weigh alone ?
   Do they weigh less than the shredded milk carton? If yes; how much?
2. How deep are the ashes that are left in the can (in centimeters)?

Copy this chart on a separate piece of paper

Weight	In grams	Height	In CM
Can		Can	
Can and shredded carton			
Can and ashes			
Ashes		Ashes	

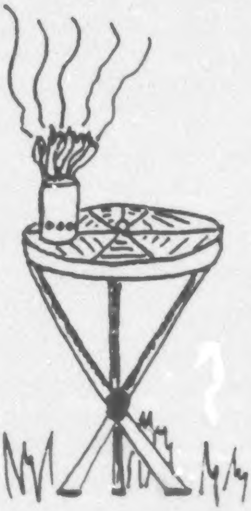
CAN YOU DO THESE?

1. Write a ratio that compares the weight of the solid waste before burning, with the weight of the waste after burning.
2. Write a ratio that compares the depth of the shredded milk carton before and after burning.
3. Describe what came out of the can while the materials were burning. Where does it go? Is everything that comes out visible?

ON YOUR OWN:

1. Think of ways in which the heat given off from the burning trash could be recovered and put to good use.
2. Are there any places in your own community where solid wastes are incinerated? If yes, do they cause air pollution ?
3. Can you think of some possible uses for the burned waste materials? Most of the waste ashes are trucked to landfill sites and buried.
4. LOOK IT UP- For further information on this topic; 1) see D5 and E5, (describe how garbage can make energy) 2) look up "Incineration" in your class encyclopedia 3) ask your school librarian to help you locate materials in the "Readers Guide to Periodical Literature" on the subject of "Solid Waste" and "Incineration."

FOR DISCUSSION: *Your primative incinerator demonstration is really an example of open burning; not controlled incineration. In many states the burning of dead leaves or trash is forbidden because of air pollution danger. In a class discussion compare the air pollution resulting from open burning with that from modern incinerators.*



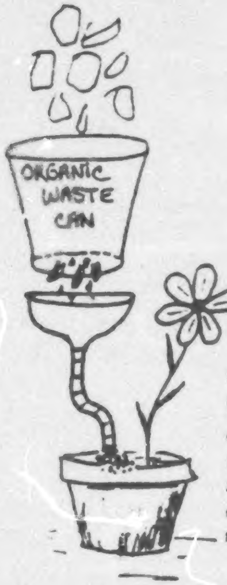
B3 GARBAGE TO SOIL

BIG IDEAS:

Decomposable wastes such as unused food, leaves, and grass clippings can be mixed with soil to make it better for growing plants. This is called composting.

Compost can be added to gardens and farm fields. Compost, when mixed with manure, conditions the soil and may add nutrients which are important for plant growth. This may reduce the need for expensive fertilizers. The chief value of compost is its use as a soil conditioner.

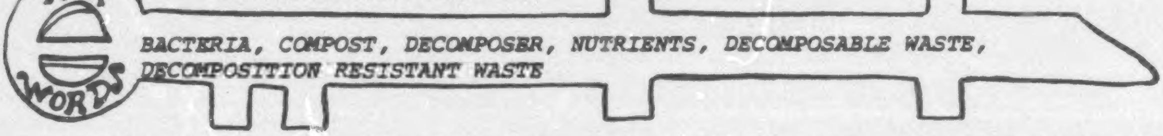
At present, the United States composts very little of its decomposable wastes.



Materials

- 2½ gallon pail or waste basket (it will be punctured)
- organic waste sample
- 10 cups each filled with soil
- 2 cups filled with manure
- nail
- hammer

YOUR JOB IS: TAKE DECOMPOSABLE SOLID WASTE AND BEGIN TO CHANGE IT INTO USEFUL COMPOST.



BACTERIA, COMPOST, DECOMPOSER, NUTRIENTS, DECOMPOSABLE WASTE, DECOMPOSITION RESISTANT WASTE

BACTERIA - TINY LIVING ORGANISMS WHICH CAN ONLY BE SEEN THROUGH A MICROSCOPE. THEY HELP TO BREAK DOWN THE BODIES OF PLANTS AND ANIMALS INTO USEFUL MATERIALS.

COMPOST - A MIXTURE OF DECOMPOSABLE SOLID WASTE WHICH IS BROKEN DOWN BY BACTERIA AND OTHER DECOMPOSERS. AFTER IT IS DECOMPOSED IT CAN BE USED TO ENRICH SOIL.

DECOMPOSER - ORGANISMS WHICH LIVE BY BREAKING DOWN OR DECOMPOSING THE BODIES OF PLANTS AND ANIMALS. BACTERIA ARE GOOD EXAMPLES.

NUTRIENTS - MATERIALS THAT FEED OR NOURISH PLANTS AND ANIMALS, LIKE FOOD.

DECOMPOSABLE WASTE - THOSE MATERIALS FROM THE BODIES OF PLANTS OR ANIMALS THAT CAN BE BROKEN DOWN IN THE SOIL BY BACTERIA AND OTHER DECOMPOSERS. EXAMPLES ARE APPLE CORES, TWIGS, LEAVES, BONES AND ANIMAL FATS.

DECOMPOSITION RESISTANT WASTE - THOSE SOLID WASTES MADE FROM SOURCES OTHER THAN FROM PLANTS OR ANIMALS WHICH ARE NOT EASILY BROKEN DOWN IN THE SOIL BY BACTERIA AND OTHER DECOMPOSERS. EXAMPLES ARE SODA CANS, CANDY WRAPPERS, BOTTLES, TIRES AND PLASTIC CUPS.

DECOMPOSABLE OR NOT?

Below is a list of solid waste items which are commonly found in the household garbage can. Some of the items are "decomposable" and others are "decomposition resistant". (The definitions for these terms are in the "key words".) See if you can match the solid waste items with the proper column.

soda can
apple core
twigs
plastic candy wrappers
leaves
soda bottle
plastic cup
chicken bone
old tire

animal fat
piece of hot dog
old pen
used razor
banana peel
styrofoam egg carton
newspaper
watermelon rind
grass clippings

DECOMPOSABLE	DECOMPOSITION RESISTANT
(GOOD FOR COMPOST)	*(POOR FOR COMPOST)*

OVER

NOW YOU'RE READY!

Divide the class into several groups.

1. Collect samples of decomposable wastes from home or school. Include grass clippings, leaves, lunch scraps, etc. . .
2. Shred the decomposable wastes up as small as possible.
3. Collect ten (10) cups of soil.
4. Collect two (2) cups of manure.

Punch nail holes in the side and bottom of the pail. Ask your PRINCIPAL'S permission to bury it near the classroom. Bury it with the rim extending above the ground.

NEXT: Mix the ingredients together and place them inside the buried pail. Sprinkle on enough water to make the mixture moist but not soggy.

HOW TO MAINTAIN YOUR COMPOST EXPERIMENT

a. Twice a week, stir the contents of the can. This provides oxygen to help the decomposers function.
b. Keep the contents very moist for the first few days and moderately moist for the next few weeks. Do not let it get too dry.
c. Keep a record of the "progress of decay" for different materials. Complete decay of the materials should take about 4 - 6 weeks.
d. When your compost is finished, bury a seed in it. Watch as your GARBAGE helps to grow a living and useful RESOURCE.

CAN YOU DO THESE?

1. How much decomposable waste does your family throw away?
2. Can this USELESS garbage be used as a USEFUL resource?
3. What happened to the materials when you composted them?
4. Can you think of other USEFUL ways to get rid of your garbage?

ON YOUR OWN:

1. Try adding 6 - 8 worms to your compost experiment. Watch the difference in the "rate of decay".
2. If you or your parents have a garden you could start a large compost pile at home and make use of your family's decomposable waste.

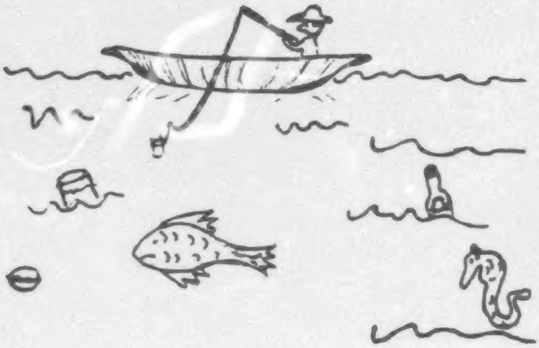
THIS IS THE PIT METHOD:

1. Measure out a 3' X 3' area in your yard.
2. Dig out the area to a depth of at least 2'.
3. Remove all loose soil. (keep the loose soil nearby so it can be used as cover material.)
4. Build your compost pile inside the pit.
5. Water and cover the pile with soil after each new addition of decomposable waste.
6. Add animal manure and turn the pile once a week.

3. LOOK IT UP - For further information on this topic:
    1. See C-1 (deals with natural recycling)
    2. Talk to a local farmer or gardener
    3. Ask your school librarian to help you locate materials in the "Readers Guide to Periodical Literature" on the subject of "Composting".

B4

"TO SEA OR NOT TO SEA"



BIG IDEAS:

Some solid wastes are dumped into the ocean. Water pollution from these wastes has proven to be dangerous to aquatic life and people. It is not legal but the ocean continues to be used as a dump.

Decomposing solid waste requires oxygen. Water contains less oxygen than air. Therefore, materials decompose more slowly in water than they do in air.

For nearly a century, man did not realize that the ocean was unable to absorb and dissolve the large amounts of solid and chemical wastes that were dumped into it.

YOUR JOB IS: COMPARE HOW SOLID WASTES DECOMPOSE IN THE OCEAN TO HOW THEY DECOMPOSE ON LAND.

MATERIALS :

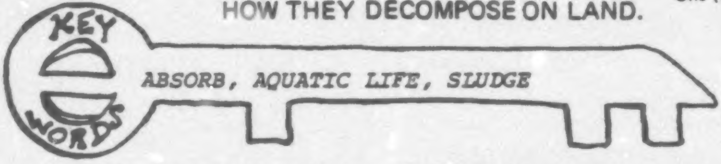
One aquarium (5 gallon or larger)

Salt water

Ten (10) pairs of solid waste samples i.e. two banana skins, two oil cans, two glass bottles, two old batteries.

Sand

One (1) wooden board (an old scrap piece 2' x 2' is fine)



ABSORB, AQUATIC LIFE, SLUDGE

ABSORB - DRINK IN OR SUCK IN AS WHEN A SPONGE TAKES WATER.
AQUATIC LIFE - ANIMAL OR PLANT LIFE THAT LIVES IN THE WATER.
SLUDGE - THE SOLID MATTER THAT REMAINS AFTER WATER IS TREATED OR DRAINED AT A SEWAGE PLANT.

BEGIN HERE: As a class . . .

You will construct two kinds of environments; an ocean environment and a land environment. You will then place identical samples of solid waste into each environment at the same time. By recording the changes that take place over a one month period, you will be able to see which environment is a better decomposer of solid wastes.

THE OCEAN ENVIRONMENT

1. Place the aquarium in a safe area where there is little classroom traffic.
2. Pour sand into aquarium (enough to cover 1-2 inches of bottom).
3. Fill the aquarium with salt water (homemade salt water).**

LAND ENVIRONMENT

1. Place a board outside near the classroom window.
2. Rain and other elements should be able to come in contact with the board.
3. The board can be placed inside the classroom if necessary as long as the solid wastes samples are dipped in fresh water for ten seconds each day.

NEXT:

1. Place ten solid waste samples into the aquarium. Record the "OBJECT", "APPEARANCE" and "DATE IN" on the chart.
2. Place the remaining solid waste samples on the board. Record the "OBJECT", "APPEARANCE" and "DATE STARTED" on the chart.
3. During the next month observe the decomposition of the objects.
4. After one month record "PHYSICAL CHANGES" in the objects in both the "Ocean Environment" and the "Land Environment."

OVER

COPY AND USE THIS CHART FOR YOUR DATA.

	OCEAN ENVIRONMENT					LAND ENVIRONMENT				
	Object	Appearance	Date		Physical changes	Object	Appearance	Date		Physical changes
			In	Out				started	ended	
Ex.	TIN CAN	LABEL ON/NO RUST	1/17	2/16	LABEL FELL OFF/ NO RUST	TIN CAN	LABEL ON/NO RUST	1/15	2/16	LABEL OFF RUSTED

CAN YOU DO THESE?

1. Did any of the solid waste materials in the "Ocean Environment" show signs of decomposition? If so, which ones?
2. Did any of the solid waste materials in the "Land Environment" show signs of decomposition? If so, which ones?
3. Which solid waste materials showed little or no change?
4. Which environment, the ocean or the land, seems better able to decompose solid waste materials?
5. Do you think that there are any poisonous chemicals coming from the solid waste objects in the aquarium? Think of one way in which this could be tested.
6. If there are dangerous chemicals present, how do you think they would affect the aquatic life and people that depend on the ocean for survival?
7. Is our miniature "Ocean Environment" able to absorb and dissolve the solid waste samples that we have thrown into it?

ON YOUR OWN:

You might have seen how difficult it is for the ocean to decompose the solid waste that man throws into it.
Barges loaded with large amounts of sludge and hazardous wastes travel to sea from our cities and return empty. Much sludge also enters the sea from ocean-side sewage disposal plants. Where oceans are not available for sludge and other solid waste dumping, lakes, rivers and bays are often used instead.

1. Where is the waste going?
2. What is it causing?
3. Who is suffering?
4. Why is it allowed?
5. How can we help stop it?
6. Are there any solid wastes than can benefit aquatic life? If yes; how?

HERE'S AN IDEA!

If you or a member of your class live near a tidal river, tidal bay, or the ocean itself, you could set up the same kind of activity under real-life conditions. *

YOU WILL NEED:

1. Two (2) tin cans.
2. Two (2) pieces of string.
3. The use of a dock piling.

Locate on the piling, the lowest point the water level drops during low tide. Tie a tin can to the piling one (1) foot below the lowest point.

Locate on the piling, the highest point the water level rises during high tide. Tie a tin can to the piling one (1) foot below the highest point.

Record the differences in the rates of decomposition between the two (2) cans.

LOOK IT UP:

For further information on this topic; 1) see C 1 (deals with natural recycling) 2) look up "Ocean Pollution" in your class encyclopedia 3) ask your school librarian to help you locate materials in the "Readers Guide to Periodical Literature" on the subjects of "Ocean Dumping" and "Ocean Pollution."

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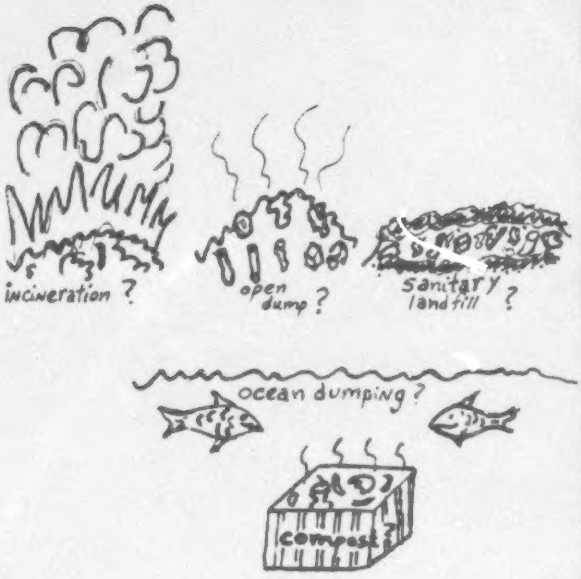
* Be sure this activity is done with an adult watching and a life jacket on.
**Homemade Salt Water = Approximately 6 ounces of Sodium Chloride for each gallon of water.

B5 "CAUTION: AIR, SOIL, AND WATER AT STAKE!"


incineration ?
open dump ?
sanitary landfill ?
ocean dumping ?
compost ?

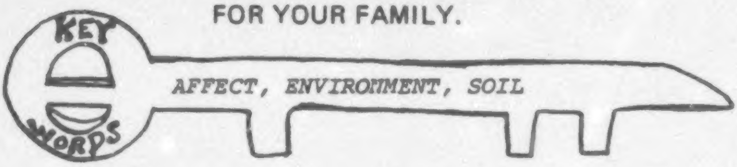
BIG IDEAS:

All of the ways in which we get rid of our solid waste result in a change in the air, soil and water that surround us.

When deciding which method of solid waste disposal to use, we must try to predict how it will affect the environment.

YOUR JOB IS : PLAN A SOLID WASTE DISPOSAL PROJECT THAT IS BEST SUITED FOR YOUR FAMILY.

Materials - None



AFFECT - TO ACT UPON OR HAVE AN EFFECT UPON.
ENVIRONMENT - A COLLECTION OF THINGS WHICH SURROUND PLANTS AND ANIMALS, INCLUDING OBJECTS, INFLUENCES, AND SITUATIONS.
SOIL - FINELY DIVIDED ROCK MIXED WITH DECAYED ORGANIC MATTER; THE PORTION OF THE SURFACE OF EARTH IN WHICH PLANTS GROW.

BEGIN HERE: Try these by yourself. . .

Without looking back, list four (4) methods of solid waste disposal that you have learned so far.

Next to each method that you listed, write A, S, or W.*

A - if the disposal method affects the AIR
S - if it affects the SOIL
W - if it affects the WATER

* You can use more than one (1) symbol if needed.

NEXT:

CONGRATULATIONS!

The Board of Solid Waste Disposal has just

assigned _______________ to the position
(Your name)

"Commander in Charge of S. W. D. ," on the

post located at _______________________.
(Your address)

OVER

YOUR DUTIES -

You are now requested to prepare a report on a solid waste disposal method (or combination of methods) that would be best suited for the troops located at the above mentioned address. Please include in your report, how the method(s) chosen for those troops will affect the environment surrounding the post.

Yours truly,

Will U. Waste

William U. Waste
Commander in Chief

B WHERE DOES IT GO?

AFTER CARRYING OUT THE 5 TASKS IN THIS UNIT,
THE STUDENT WILL BE ABLE TO:

	Task which meets these objectives
1. Describe the difference between open dumping and sanitary landfilling.	1
2. Tell which method is presently being used by their community.	1
3. Develop an awareness of the health hazards and costs involved in open dumping and sanitary landfilling.	1
4. Understand the benefits and hazards of incineration.	2
5. Tell how composting can preserve the environment and save money.	3
6. Describe how some solid wastes could be made useful.	3
7. Describe why an ocean environment is poorly suited for solid waste disposal.	4
8. List four (4) methods of solid waste disposal.	5
9. Identify the environmental damages incurred by the various methods of solid waste disposal discussed in this unit.	5

GLOSSARY

AIR POLLUTION -- Contamination of the air by anything that makes it less clean or pure. These include smoke particles, dust particles, and gases like carbon monoxide and sulphur dioxide.

AQUATIC LIFE -- Animals or plants living in the water.

BACTERIA -- Tiny living organisms which can only be seen through a microscope. They help to break down the bodies of plants and animals into useful material.

COMPOST -- A mixture of organic material which is decomposed by bacteria and other decomposers into a humus-like mixture. This mixture provides nutrients for plants.

DECOMPOSE -- To break down or separate into simpler compounds.

DECOMPOSER -- Organisms which obtain their energy by decomposing dead plants and animals and their wastes. Examples are bacteria, scavengers and other small organisms.

LEACHATE -- Rain water or liquid that has percolated through solid waste and has extracted highly concentrated and sometimes toxic materials from the solid waste.

METHANE GAS -- A highly flammable and explosive gas, both odorless and colorless. The gas is produced from decomposing garbage or other organic material.

OPEN DUMPING -- Illegal dumping or disposal of solid wastes in unmarked areas.

ORGANIC WASTE -- Wastes from the bodies of plants or animals or from their decomposition.

SANITARY LANDFILLING -- A method of solid waste disposal which inhibits odors and prevents the surface decompostion of solid wastes by covering the waste daily with soil.

TEACHER GUIDE

1. OPEN DUMPS AND SANITARY LANDFILLS

(Can you do these?)

1. The solid waste objects should begin to decrease in size or decompose.
2. Yes, where organic materials are present.
3. These "empty spaces" or "holes" under the ground often cause the houses to settle or "sink" at a rapid and sometimes dangerous rate. The methane gas that is produced by decomposing garbage often migrates upward into the housing structures. The possibility of fire and/or explosion is greatly increased. Odors are sometimes a problem. Leachate often reaches and pollutes the ground water below.
4. Recreation site, golf course, park, etc.

2. GARBAGE TO ASHES

(On your own)

1. Heating water, making steam, creating energy (see D5).
2. Most likely, unless special filters are used.
3. Can be used as "fill"; certain ashes used in gardening and road construction (not a wide variety of uses).

3. GARBAGE TO SOIL

(Can you do these ?)

1. Students might want to keep a record for a week.
2. Yes.
3. See key words "Compost, Decay and Decomposer."

4. TO SEA OR NOT TO SEA

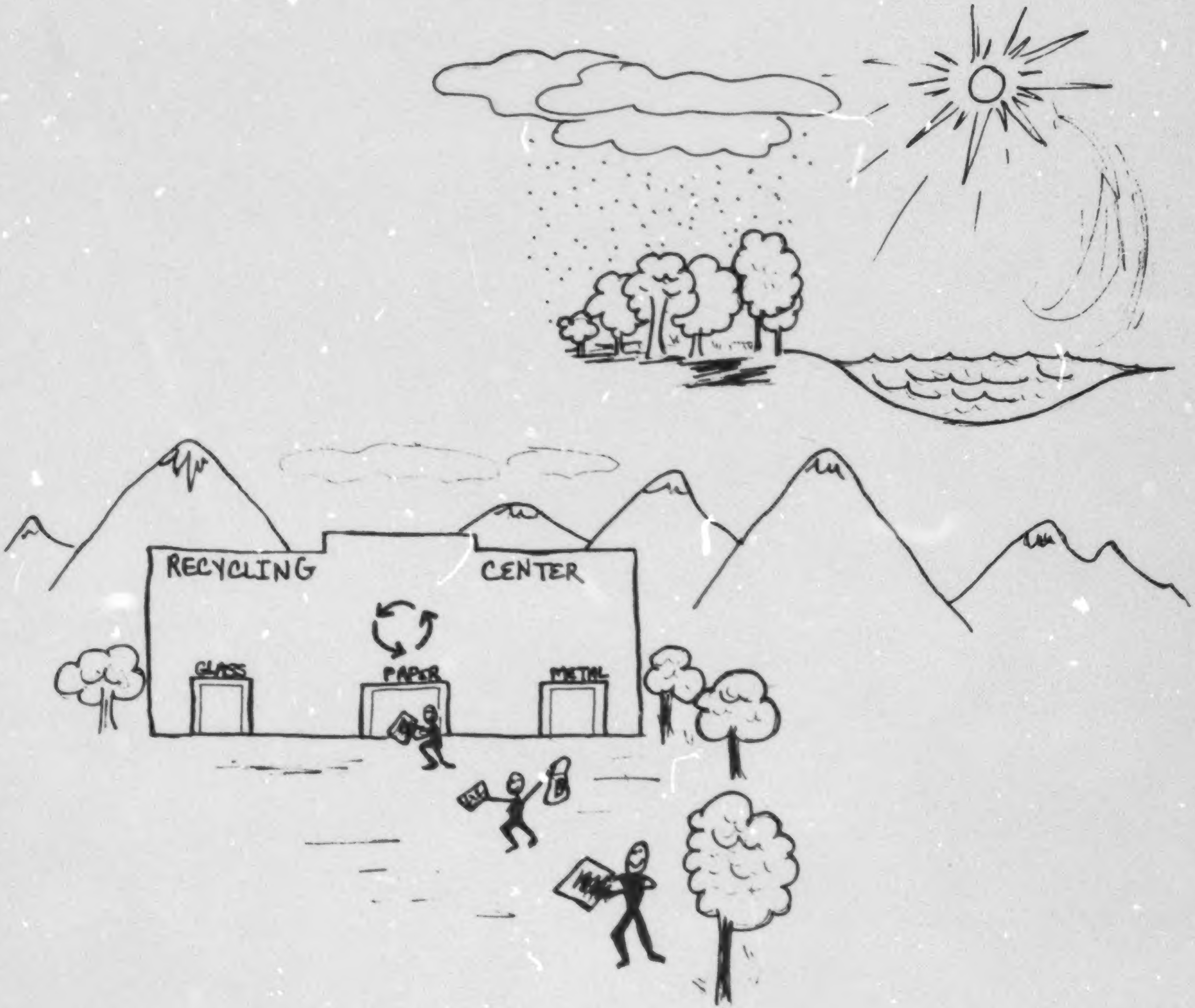
(Can you do these?)

3. Plastic, glass (inorganic materials).
4. The land.
5. Depending on sample items: old batteries = battery acid (yes).
   oil cans=oil (yes) placing an aquatic animal or plant in it, water test kit.
6. The presence of hazardous chemicals in the water threatens the lives of aquatic animals, plants, and humans.
7. Probably not.

(On your own)

1. To the ocean where it will either sink to the bottom, be suspended, or float on the surface where it will eventually wash up on our beaches.
2. Pollution.
3. Aquatic animals, plants and people.
4. Laws are not enforced.
5. Projected date to end all ocean dumping is December 31, 1981. Have students think of projects such as posters, letters, murals, etc. that support this law.

6. Some solid wastes such as old car bodies, tires, and other large objects can provide habitat and shelter for aquatic life.



"RECYCLE EVERYTHING," WASTE IS A RESOURCE OUT OF PLACE
"URBAN WASTE IS URBAN ORE," TRASH IS CASH
"TRASH IS OUR ONLY GROWING RESOURCE" ARE CRIES
NOW ECHOING THROUGHOUT THE LAND.

unknown

At least two thirds of the material resources that we now waste could be reused or recycled without significant changes in the way we live. If products were made for both durability and ease of recycling, the waste streams of the industrial world could be reduced to small trickles. Education about the solid waste problem is the first step.

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING ACTIVITIES:

C1 THE NATURAL RECYCLING OF SOIL AND WATER

SKILLS: Reading comprehension, vocabulary, conducting experiments, working independently, recording observations, library skills, measuring weights.

PREPARATION: None

In nature all things that come out of the earth are returned to it by a natural recycling process. Recycling man-made litter is not the same as the natural recycling process in nature, however, man-made litter may be slowly recycled and made useful again. In this lesson the student will become aware of the natural recycling which takes place in the soil and water.

C2 REUSING YOUR SCHOOL WASTES

SKILLS: Reading comprehension, vocabulary, measuring weights, multiplication, creative writing, sketching.

PREPARATION: Bring in large cardboard box from home

Reuse,the repeated use of the same object,is a way to waste less and reduce shortages of natural resources. The earth's natural resources are limited, and will soon be used up if we do not begin to reuse what we have already taken out.
This lesson will demonstrate the amount of reusable material the students generate in the classroom.

C3 RECYCLING BY MAN

SKILLS: Reading comprehension, vocabulary, creative writing, working independently, following instructions.

PREPARATION! See materials

The recycling of paper can help to solve the serious environmental problems associated with solid waste disposal. This lesson will enable the students to make new paper from old paper with a process similar to that of a paper recycling mill.

C4 TOO MANY WRAPPINGS

SKILLS: Reading comprehension, vocabulary, measuring weights, subtraction, creative design, working independently, recording observations, values clarification.

PREPARATION: Bring in 3 packaged goods.

The recycling and reuse of materials would be easier if they were first made to be recycled or reused, not made to be thrown away. Modern day overpackaging and the increasing use of disposable items add to the large amounts of solid waste thrown out. In this lesson the students will identify and record the overpackaging characteristic of common store goods. They will design their own packaging for the product with the conservation of materials in mind.

C5 VISITING A RECYCLING CENTER

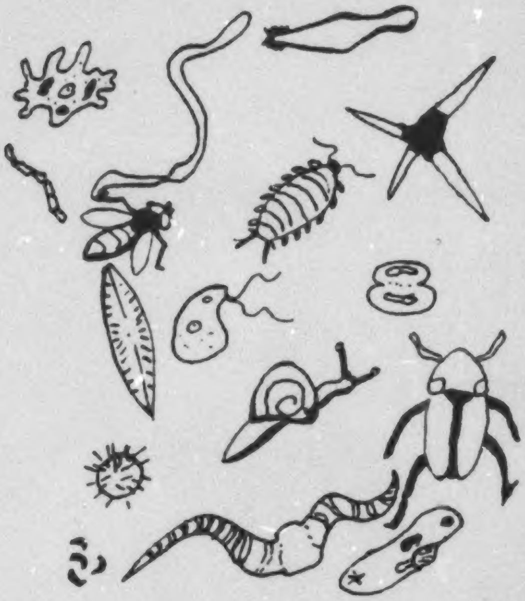
SKILLS: Reading comprehension, vocabulary, decision making, letter writing.

PREPARATION: None

Resource recovery from solid waste can reduce the solid wastes we must dispose of, save energy needed to make new products and reduce pollution in sanitary landfills and open dumps. As natural resources disappear the economic benefits of recycling or reuse become greater. This lesson will enable the students to observe a recycling plant, and perhaps spur an interest to start their own recycling program.

Each of these lessons can be completed in one 30 - 50 minute class period but they can be expanded to 2 - 3 class periods depending on teacher discretion and class interest.

C1 NATURAL RECYCLING IN SOIL AND WATER

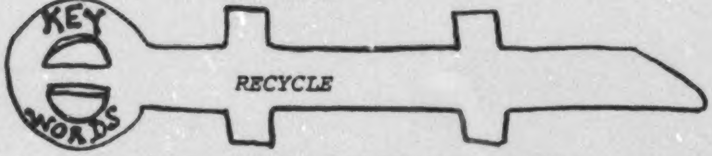


BIG IDEA:

In nature materials that come from the earth are returned to the same form by a natural recycling process called decomposition.

Some man-made solid wastes like paper and wood can be naturally recycled by decomposers. Other solid wastes like glass and metal must be artifically recycled by man or they will remain in the environment.

YOUR JOB IS: COMPARE THE DECOMPOSITION OF VEGETABLE SCRAPS TO THE DECOMPOSITION OF GLASS BOTTLES.



RECYCLE - *MAKE PRODUCTS FROM MATERIALS WHICH ARE NO LONGER USED.*

MATERIALS

(Each Student)
Vegetable scraps
2 glass bottles
4 mesh bags (nylon stockings,onion bags)

(Group)
Scale
Ball of string
Digging tool

Nature recycles waste through scavengers and decomposers. These small organisms live in the soil and water and obtain their food from dead material.

Examples of scavengers include snails, earthworms, crayfish, and tadpoles. Bacteria and molds are examples of decomposers found in all environments. The decay of foods and plant and animal bodies is the work of scavengers and decomposers.

BEGIN HERE:

1. Place the vegetable scraps in two of the mesh bags.
2. Place the glass bottles in the other two mesh bags.
3. Observe the contents of each bag and record its appearance on the charts. (on reverse side). Weigh each bag and record.
4. Close the openings of each bag and tie them shut with string. Leave about 10 inches of string on each bag to tie your sample to a stake or tree.
5. Place one mesh bag containing vegetable scraps and another mesh bag containing glass under water in a pond or stream. Tie the strings to a tree or stake near the water's edge.
6. Dig a hole in the ground about 12 inches deep. It must be large enough for two mesh bags. One will contain the glass bottle and the other will contain vegetable scraps.
7. Place the two bags into the hole and cover them with soil.
8. Allow 4 - 8 weeks to pass before retrieving your bags from the soil and water.
9. Inspect the bag contents and weigh each one. Recording the data on your charts. Be sure to drain the water from the bags before weighing them.

* This task card was adapted and modified from "Natural Recycling with Water and Soil," Outdoor Biological Instructional Strategies, Lawrence Hall of Science, University of California at Berkeley.

OVER

WHAT HAPPENED IN NATURAL RECYCLING:

SOIL

	Weight		Appearance of bag and contents	
	BEFORE	*AFTER*	*BEFORE*	*AFTER*
Bottle				
Vegetable scraps				

WATER

	Weight		Appearance of bag and contents	
	BEFORE	*AFTER*	*BEFORE*	*AFTER*
Bottle				
Vegetable scraps				

NEXT:

Look at both the soil and water charts to examine the changes in weight and appearance of the food scraps before and after the study. What happened to the food scraps? What happened to the bottle?
1) Write down five things you throw away that are like the glass. What makes them alike?
2) Write down five things you throw away that are like the vegetable scraps.

CAN YOU DO THESE?

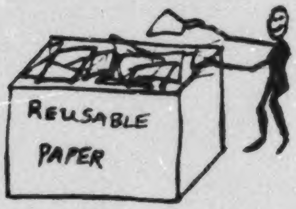
a) What organisms are responsible for decomposing the vegetable scraps?
b) Are the same organisms present in both the water and soil study?
c) Does the bag material have an influence on the decomposition process?
d) Can man depend on nature to cleanup his litter, or must he do it himself? Explain your answer.

ON YOUR OWN:

1) Go to your school library and take out a book on biology to learn more about the small animals responsible for recycling the vegetable scraps.
2) To learn more about natural recycling see lesson B4.
3) If you want to help clean up people's litter see the Eco-Action Unit-F.

C2

RE-USING YOUR SCHOOL'S WASTES

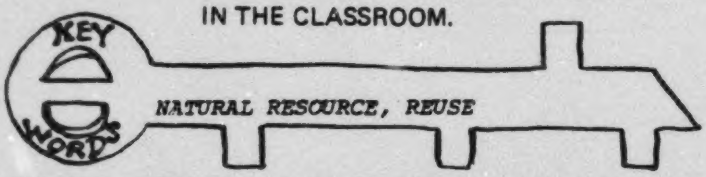


BIG IDEAS:

"Reuse," the repeated use of the same object, is a way to waste less of the earth's natural resources.

The earth's natural resources are limited and will soon be used up if we do not reuse what we have already taken from the earth.

YOUR JOB IS: COLLECT AND WEIGH THE AMOUNT OF REUSABLE PAPER YOU PRODUCE IN THE CLASSROOM.



MATERIALS

Kitchen or laboratory spring scale

NATURAL RESOURCE - MATERIALS WHICH ARE FOUND IN NATURE. PEOPLE USE THEM TO MAKE PRODUCTS AND TO PROVIDE ENERGY. EXAMPLES ARE WOOD, COAL, GOLD AND WATER.
REUSE - USE A PRODUCT OR MATERIAL OVER AND OVER AGAIN.

BEGIN HERE:

BEGIN HERE:

1. Bring in a large cardboard box.
2. Label it, "Reusable Paper", and put your name in the corner. Place it next to your desk.
3. From now on, put all of your scrap paper in your box instead of the trashcan.
4. Weigh your paper on a scale after one week to see how much paper you have saved. Record your data.
5. After this, you may use your scrap paper for writing poems, song lyrics, letters, short essays, drawings, etc.
6. You should continue collecting your paper; don't be afraid to use it if you need it. Keep thinking of more uses for your paper. (paper airplanes, too!)
7. After each week, weigh your reusable paper again, and record the weight in the "Reusable Paper Table".

CAN YOU DO THESE?

After one month has passed answer the following questions:

1. How much paper, in weight, did your class save in one month?

2. How much paper, in weight, could your class save in one year?

3. What evidence do you have to show how much paper you have reused?

4. Make plans to expand your paper reusing program throughout your school. Share your ideas with the class. Perhaps you could start a class project.

5. You can do this same study with other reusable materials by making things out of paper, metal, and plastic.

OVER

6. Ask your art teacher for ideas.

7. Challenge other students in your class to a contest to see who can think up the most uses for their paper.

REUSABLE PAPER TABLE

Week 1	oz	lbs	Week 5	oz	lbs
Week 2	oz	lbs	Week 6	oz	lbs
Week 3	oz	lbs	Week 7	oz	lbs
Week 4	oz	lbs	Week 8	oz	lbs

ON YOUR OWN:

For more information on reusing things you can write to:

Waste Not, Want Not
Solid Waste Administration
New Jersey Department of Environmental Protection
P.O. Box 1390
Trenton, New Jersey 08625

How can people conserve natural resources by reusing materials? (ex. - if you reuse paper you can conserve trees). Think of at least three other ways to conserve natural resources.

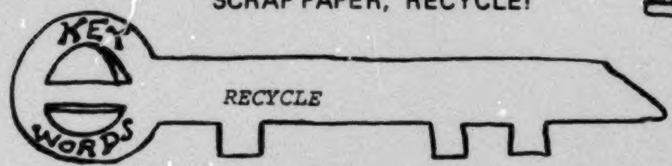
* NOTE: Save your paper for the next lesson, C3, Recycling By Man.

RECYCLING BY MAN

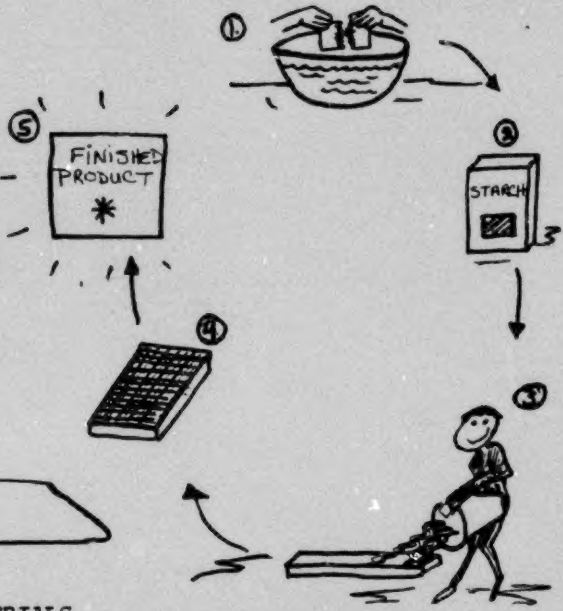
BIG IDEAS:

The recycling and re-use of solid waste materials is one way to reduce the large amount of solid waste people must dispose of.

YOUR JOB IS: MAKE NEW PAPER FROM SCRAP PAPER, RECYCLE!



RECYCLE - MAKE NEW PRODUCTS FROM MATERIALS WHICH ARE NO LONGER USED.



MATERIALS

8-10 pieces of tissue or 2-3 pieces of used paper.
A piece of screen about 3 in. square.
A flat pan a little larger than the screen.
3 or 4 pieces of white blotting paper the size of the screen.
A bowl and egg beater, a round jar, newspaper and instant starch to make the paper stronger.

BEGIN HERE:

1. Use the paper you saved in Lesson C2.

2. Tear the paper into very small bits in a bowl. Add 2 cups of hot water and beat the paper and water with an egg beater to make it pulpy. Add two teaspoons of starch to the pulp. Mix it well.

3. Pour the pulp into the flat pan.

4. Slide the screen into the bottom of the pan and move it around until it is evenly covered with the pulp.

5. Lift the screen out carefully. Hold it level and let it drain for a minute. Then put the screen, pulp side up, on a blotter on some newspaper.

6. Put another blotter over the pulp, more newspaper over that, and roll the jar over it to squeeze out the rest of the water.

7. Take off the top newspaper. Turn the blotter sandwich over so that the screen is on the top. Then take off the blotter and screen very carefully. Do not move the pulp! There is your paper. Put a dry blotter on the pulp and let the pulp dry. You have just made paper from paper.

OVER

NEXT:

1) Obtain examples of both recycled and non-recycled paper. Mix them up and challenge your class members to pick out the recycled paper. Can you tell the difference?

2) Look for recycled paper products when you go to the store.

CAN YOU DO THESE?

1. Describe the difference between reusing and recycling materials.

2. Write a short story on what it would be like if everything that you own was reused or recycled again.

ON YOUR OWN:

1) For more information on recycling or reusing write to: Solid Waste Information, U.S. Environmental Protection Agency, Cincinnati, Ohio 45168, for the following booklet:

   Number 446, "What You Can Do To Recycle More, " A guide for citizens interested in ways to recycle paper.

2) Write to local paper companies and request the prices of both recycled and non recycled paper. Which one is more expensive? Why?

3) You may want to visit a local paper mill that recycles paper. Ask your teacher for help.

4) Find out if your school uses recycled paper.

5) Write to a local paper company and ask them if they support paper recycling. Ask them for their viewpoints on recycling.

C4 TOO MANY WRAPPINGS

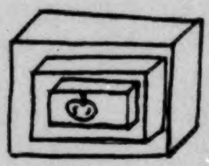
BIG IDEA:

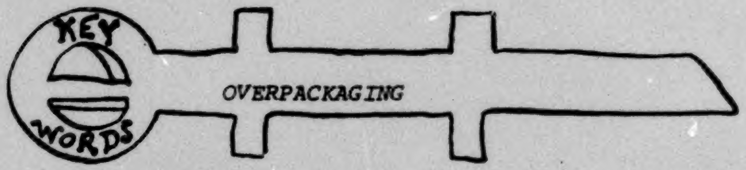
Modern day packaging, although it helps to preserve products for a longer time, also adds to the large amounts of solid wastes which must be disposed of. Many of these products are overpackaged.

MATERIALS

Kitchen or laboratory spring scale

YOUR JOB IS: REDESIGN THE PACKAGING OF PRODUCTS TO MAKE THEM RECYCLABLE.





OVERPACKAGING - PACKAGING A PRODUCT WITH MORE MATERIAL THAN IS NECESSARY TO PROTECT IT UNTIL IT REACHES THE CONSUMER.

BEGIN HERE:

1) Bring in 3 of your favorite packaged foods from home.

2) Weigh the food inside the package. Weigh the package alone. (Use the chart on the back to record your data).

3) After you record the weight of the food and the package answer the following questions:

   a) Does the food product need packaging?

   b) If yes, does it have too much packaging?

   c) How does the packaging help the product? Does it protect the product or make it attractive?

   d) Could the amount of packaging material be reduced without hurting the product? How?

   e) Is the packaging material made up of more than one material? If it is, can the materials be recycled? How?

   f) Would you give up one of your favorite foods if it were overpackaged?

OVER

g) Decide which items are overpackaged. Why are they overpackaged?

h) Decide which items are not overpackaged. Does it hurt the product?

NEXT:

1) Redesign the packaging for one of your favorite packaged foods. Use less material than the original package. Use materials which can be recycled and/or reused.

Recyclable Materials	Reusable Materials
glass (bottles, jars)	plastic (containers, holders)
aluminum cans	glass (bottles, jars)
metals	metals
paper	paper

2) Questions you should ask yourself about the package:
   a. Does it use less material than the original package?
   b. Is the package material reusable or recyclable?
   c. Does the package protect the product?
   d. Is the package easy to handle and store on shelves?
   e. Is the package appealing to the customer?
3) Send your packaging idea to the manufacturer of the product. (The address can usually be found on the package.)

FOOD CHART

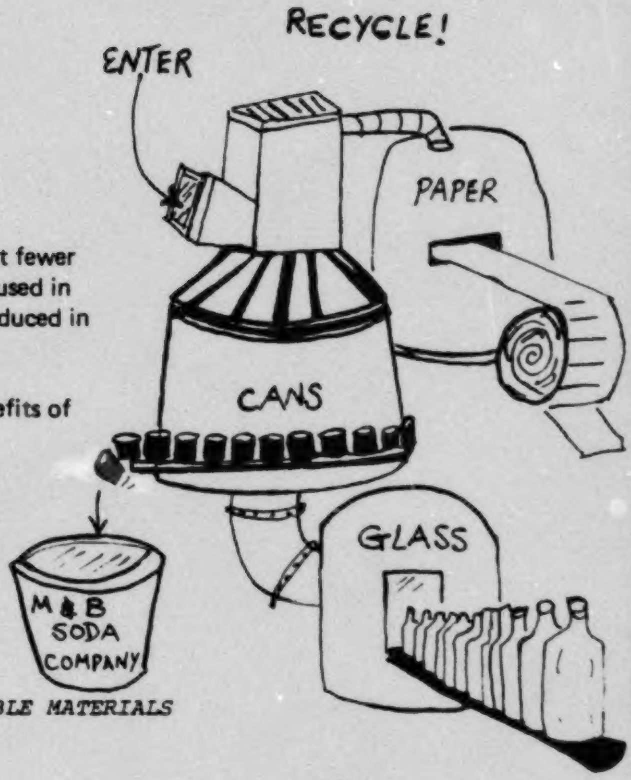
Food Type	*Weight*		*Reusable or Recycleable Material*
	Package	*Food*	

ON YOUR OWN:

1) If you use paper, plastic or aluminum foil for your school lunch, reuse the wrappings. If you use them twice, you have saved one half of the materials needed for one time use. You have saved the energy required to produce new wrapping. You help to prevent pollution created in the disposal of the wrappings.
2) Below is a list of other ways you and your family can reuse and recycle packaging materials:
   Buy milk in cardboard containers instead of plastic.
   Buy margarine or butter in cardboard cartons instead of plastic.
   Wash plastic bags and reuse at home and at the grocery store.
   Wash and reuse plastic silverware.
   Use the plastic liners for garbage cans more than once.
   Use wax paper instead of plastic wrap.
   Save plastic containers and cartons for art projects.
3) For more information write to:
   Recycling And The Consumer, U.S. Environmental Protection Agency, Region 2, Solid Waste Information, Cincinnati, Ohio 45268. An Introduction to Recycling and Source Reduction. What the individual can do to start them.
   Toys: Fun In Making. U.S. Dept. Of HEW, Revised edition, 1979. U.S. Government Printing Office. Order No. OHD - 79 - 30031. Instructs children on how to make toys out of common throwaway items, such as toilet paper rolls.
   Waste Not, Want Not, New Jersey Department of Environmental Protection. Solid Waste Administration P.O. Box 1390, Trenton, N.J. 08625.

C-5

VISITING A RECYCLING CENTER

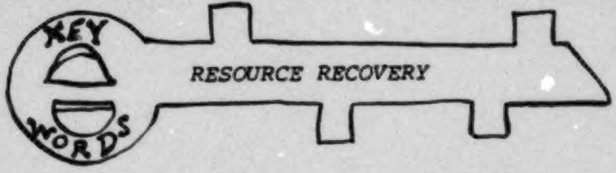


BIG IDEA:

Resource recovery from solid waste can mean that fewer natural resources are used for products, less energy is used in the manufacture of products, and less pollution is produced in land and water.

As natural resources disappear, the economic benefits of recycling and reusing materials increases.

YOUR JOB IS: VISIT A RECYCLING CENTER.



RESOURCE RECOVERY - THE RECOVERY OF VALUABLE MATERIALS AND/OR ENERGY FROM SOLID WASTES.

BEGIN HERE:

MATERIALS

None

1) Below is the address of one of the largest glass recycling plants in the northeast. Discuss with your teacher the idea of a field trip to this facility. They would be more than happy to host a field trip for students who are studying about solid waste. For more information ask your teacher to call Ms. Selena Jill Fox at (609) 767-8855, or write to her at:

Recycling Enterprises, Inc.
Egg Harbor Road
Berlin, N.J. 08009

2) Listed below you will find the addresses and phone numbers of drop-off points, or places to take recyclable materials. By starting to recycle now, you can save natural resources, conserve energy and at the same time clean up the environment. Choose the address closest to your house or school. Ask your teacher about starting a classroom recycling program. Contact your state or county Solid Waste Administration for similiar drop off points in your own area.

BURLINGTON COUNTY DROP OFF POINTS:

TOWN	SPONSOR	MATERIALS ACCEPTED	HOW TO CONTACT	SCHEDULE
Cinnaminson	Public Works Dept.	Cardboard All glass Bulk items Used Motor Oil	Public Works Dept.	Anytime
Evesham	Township	Bulk Metal Items Stoves	Pickup 609-983-2798	1st & 3rd Friday of Month
Moorestown	Township	All glass Aluminum cans Bi-metal cans	Public Works 601 E. 3rd St.	Anytime

OVER

CAN YOU DO THIS?

List 3 reasons why it is good to practice resource recovery.
Describe the way bottles are recycled at the recycling center.

ON YOUR OWN:

For more information on paper recycling write to:

U.S. Environmental Protection Agency,
Washington, D.C. 20460

1. Number 420, Paper Recycling in the U.S. Lingle, S.A. reprinted from Waste Age, November 1974, 4 pg. An overview of the wastepaper market in the U.S., covering supply, demand and price.

2. Number 446, What You Can Do To Recycle More Paper. Environmental Protection Agency 1975, 12 pg. A guide for citizens interested in ways to recycle paper.

Other sources of information on recycling are:

Salvation Army
They have been in the business of salvaging and reusing products for years.

Antique shows and flea markets these are good places to observe reuse first hand.

AFTER CARRYING OUT THE 5 TASKS IN THIS RECYCLING AND REUSE UNIT, THE STUDENTS WILL BE ABLE TO :

	TASKS WHICH MEET THESE OBJECTIVES
1. Develop an awareness of the natural recycling of the earth's soil and water.	1
2. Identify several decomposers and describe 2 examples of chemical breakdowns.	1
3. Save paper scraps in the classroom and reuse them for poems, essays or songs.	2
4. Weigh the paper waste saved and calculate the amount of reusable paper their school generates.	2
5. Define overpackaging and list at least 2 reasons for it, and packaging materials that can be recycled or reused.	3
6. Describe how some packaging material can be reused.	3
7. Define and give examples of the words "recycle " and "reuse".	4
8. Make new paper from used paper.	4
9. Describe the operation of a bottle recycling plant.	5
10. Identify local recycling programs.	5

GLOSSARY

NATURAL RESOURCES - Matter produced by nature which is sometimes used to create energy, or make useful objects. It includes forests, coal, water, ect.

OVERPACKAGING - Packaging a product with more material than necessary to protect it until it reaches the consumer.

RECYCLE - Make new products from materials which are no longer used.

RESOURCE RECOVERY - The recovery of useful and valuable materials or energy from solid waste.

REUSE - To use a product or material over and over again.

TEACHER'S GUIDE

C-1 NATURAL RECYCLING OF SOIL AND WATER

(Can you do these?)

A. Snails, earthworms, crayfish and tadpoles
B. Yes
C. Yes

C-4 TRASH TO PAPER

(Can you do these?)

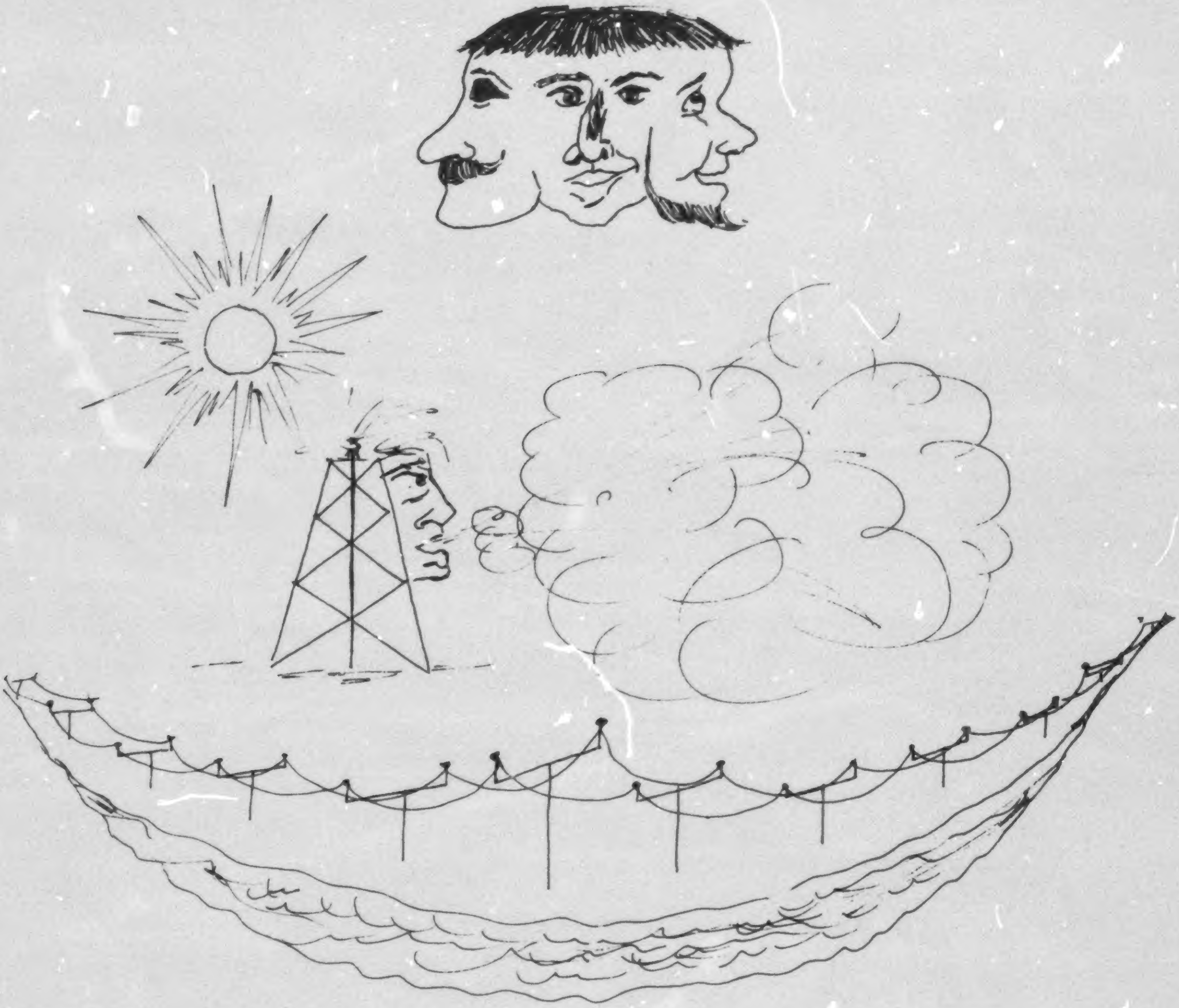
1. See key words

C-5 VISITING A RECYCLING CENTER

(Can you do these?)

1A. It reduces the solid waste we must dispose of.
  B. Saves energy needed to make new products.
  C. Reduces pollution from sanitary landfills and dumps.

CESC
CETA
5-6



"America is faced with an energy dilemma described as the 'Moral Equivalent of War.' Our nation's productivity and our own lifestyles are threatened by declining availability of some fossil fuels and the greatly increased prices of others. For the first time in the history of the United States, our economic well-being is dependent upon uncertain supplies of foreign fuel. The nation must decrease its reliance upon these scarce and expensive fuels and develop alternate energy sources to meet its needs."

Caryl M. Kline
Pennsylvania Dept. of Education
1977

We use energy for everything we do. We are quickly using up the energy supplies that nature has provided. We are debating the safety of the use of nuclear power and the burning of solid waste as an energy source. These processes may solve or create more energy problems. An understanding of the energy we use and of its sources is necessary to solve these problems.

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING LESSONS:

D 1 ENERGY MAKES THINGS GO

PREPARATION: None

SKILLS: Reading comprehension, vocabulary, recording information, writing, sketching, group cooperation, decision making.

Energy is the strength or power to make things go and grow. In this lesson the students will become aware that energy is used for everything we do. It will show them how energy is used at home, at school, in their community and in the countryside.

D 2 AN ENERGY USE MURAL

PREPARATION: None

SKILLS: Reading comprehension, vocabulary, sketching, mural-making, oral reporting, group cooperation, decision making.

Energy is used by four primary groups of consumers. These are: 1) Residential - energy used around the home, such as power for the T.V., stove, heater and lights. 2) Transportation - energy used for traveling place to place, such as power for our cars, planes and ships. 3) Industrial – energy used to power the many kinds of machines for manufacturing goods. 4) Commercial - energy used for the sale of manufactured goods and to run stores. This lesson will enable the students to see how energy is used by energy consumers. The students will design murals depicting energy use.

D 3 WHERE DOES THE ENERGY WE USE COME FROM?

PREPARATION: Bring in magazines and newspapers from home.

SKILLS: Reading comprehension, vocabulary, research techniques, collage making, oral reporting, organizing information.

All energy reaches the earth from the sun. Some energy is captured from the sun by the earth as coal, oil, or natural gas. In this lesson the students explore various sources of energy in their own lives by making "energy collages."

D 4 HOW ENERGY IS CHANGED TO MAKE IT USEFUL

PREPARATION: None

SKILLS: Reading comprehension, vocabulary, recording information, decision making.

Energy can seldom be trapped or stored. We do have some stored energy in fuels like oil or gasoline. To use this stored energy, the energy must be changed to a new and active form. The focus of this lesson is the conversion of energy from one form to another. The student will discover how energy is made useful through this conversion process.

D 5 TRASHPOWER

PREPARATION: None

SKILLS: Reading comprehension, vocabulary, recording observations, conducting experiments, measurements, interpreting observations, decision making, group cooperation.

Solid waste can be converted to energy. This helps to reduce the use of fossil fuels such as coal and oil. It also reduces the amount of solid waste that has to be disposed of. In this lesson the student will investigate how energy can be produced from solid waste materials.

Each of the lessons can be completed in one 45 minute class period, but they can be expanded to 2 - 3 class periods depending on teacher discretion and class interest.

D-1

ENERGY MAKES THINGS GO

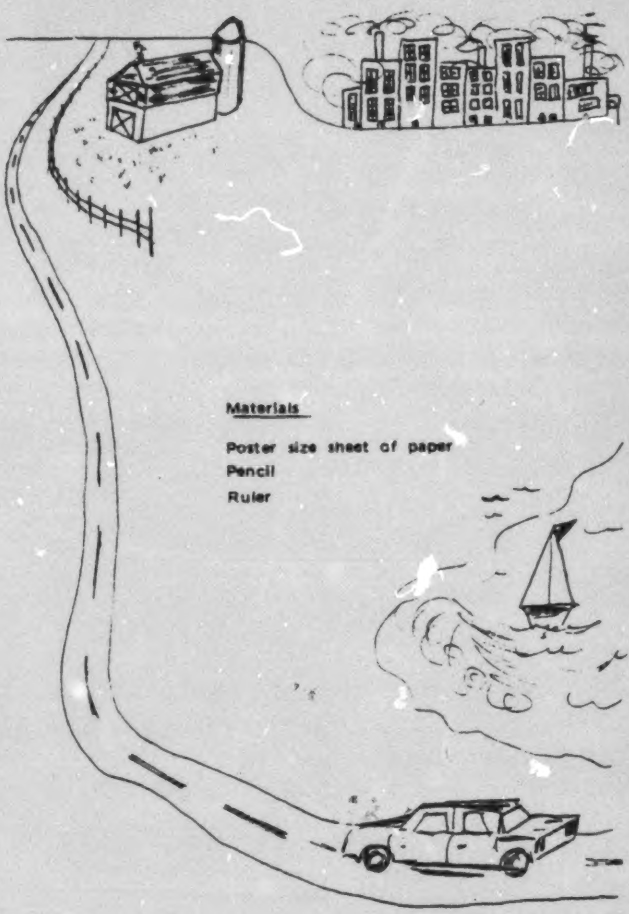
BIG IDEAS:

Energy is the strength or power to make things go and grow.

Energy comes in many different forms:

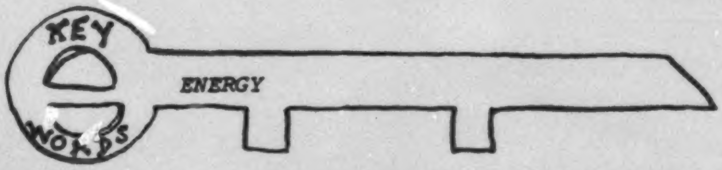
- A. piece of wood burning
- B. lighted lamp bulb
- C. a wind mill
- D. a hot stove
- E. the sun
- F. a radio
- G. a potato

YOUR JOB IS: MAKE A SURVEY TO SHOW ENERGY MAKING THINGS GO AND GROW.



Materials

Poster size sheet of paper
Pencil
Ruler



ENERGY - THE STRENGTH OR POWER TO MAKE THINGS GO AND GROW.

BEGIN HERE: Divide up into four groups.

1. Make up a definition in your own words of what the word "energy" means to you.
2. Compare your definitions with the rest of your group. Are they similiar? Are they different? Decide which definition is best. Why?
3. Think of the ways you use energy at home. Fill in the table on the next page.

OVER

THE KINDS OF ENERGY WE FOUND BEING USED

TABLE 1

Around home	How to conserve	Around school	How to conserve	Around town	How to conserve	The countryside	How to conserve
EX. OVEN	Turn it off as soon as you are through cooking	light	Turn it off in the daytime			CAR	Drive slower

4. Put up your tables on the bulletin board or wall. Keep adding to your tables each time you discover a new way energy is used.

5. We are having an energy crisis in the world today. We use energy for everything we do. With your group members, discuss ways you feel we can conserve energy. Write them in the table.

6. With your group, think of and write :
   a. The many different things energy does .
   b. The places energy is being used the most.
   c. Things you can do to conserve energy.

CAN YOU DO THESE?

1. Find and draw at least 2 energy changes.

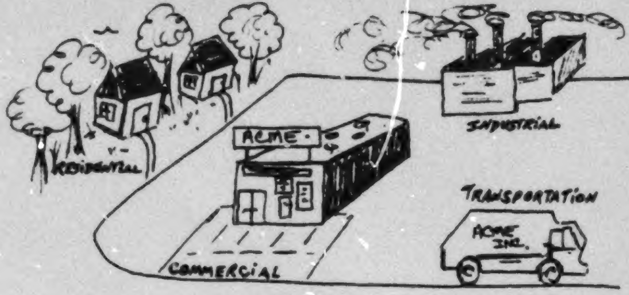
OWN YOUR OWN:

Carry a note book with you for a full day. Write down every time energy does something for you. Explain how the energy helped you.

For more information on energy, you can: 1. look in your classroom library science books; 2. check out books on energy from your general library; 3. write to your local electric company and ask them for information on conserving energy. (your parents can help you get the address).

D 2

AN ENERGY USE MURAL



BIG IDEAS:

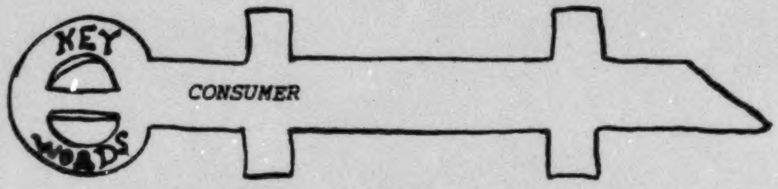
Energy is used by four main consumers;

1. Residential - Energy used around the home. Power for the T.V., stove, heater and lights.
2. Transportation - Energy used for traveling. This energy powers cars, flies planes, drives bikes, sails ships, and helps us walk.
3. Industrial - Energy used for finding or processing primary sources of energy. Also used to power the many kinds of machines for manufacturing goods.
4. Commercial - Energy used for the making and selling of our manufacturing goods. Power for our stores.

MATERIALS

paper to make mural
crayons
colored pencils
paint

YOUR JOB IS: MAKE A MURAL TO SHOW ENERGY USE BY ONE OF THE ABOVE FOUR GROUPS.



CONSUMER - ONE WHO USES ECONOMIC GOODS OR SERVICES.

BEGIN HERE: Divide into four groups.

1. Select one of the above four consumers.
2. Each group needs a large open space of wall or blackboard. Ask your teacher to advise you about the best way of making murals in your classroom.
3. Each group may want to discuss the ways energy is used by the consumer. List the ways on a sheet of paper.
4. For example, if your mural consumer is residential you can show how energy is used in the kitchen, living room, bedroom, bathroom, workshop, garage, yard or garden. The milkman uses energy bringing your milk. What about the mailman?

OVER

5. As each member of the group draws his/her part of the mural, that person should be prepared to explain any part of the mural to the rest of the class. If your teacher does not approve making a mural see, "On Your Own."

CAN YOU DO THESE?

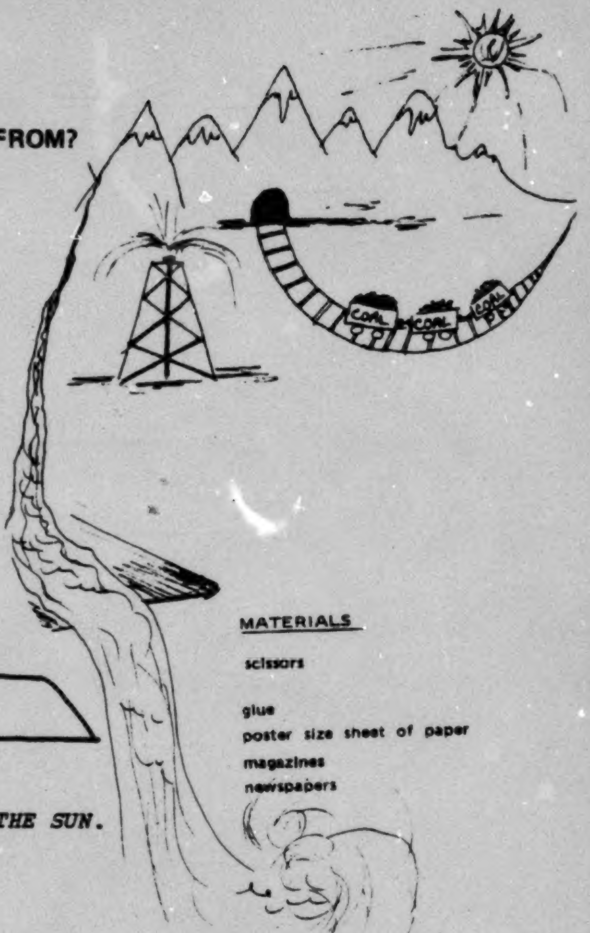
As each group explains its energy mural, perhaps you find energy uses left out. Write them down and explain to the class how they fit into the mural.

ON YOUR OWN:

If you can't make murals in school, maybe you and your friends may want to make your own mural.

D-3

WHERE DOES THE ENERGY WE USE COME FROM?



BIG IDEAS

All energy reaches the earth from the sun. Some energy is captured by the earth as coal, oil, natural gas, or steam trapped inside the earth.

YOUR JOB IS: MAKE AN ENERGY COLLAGE TO SHOW WHERE THE ENERGY WE USE COMES FROM.

KEY WORDS

PRIMARY - ENERGY SOURCE

PRIMARY ENERGY SOURCE - ENERGY FROM THE SUN.

MATERIALS

scissors

glue
poster size sheet of paper
magazines
newspapers

BEGIN HERE:

1. Think about where the energy you use comes from. Make a list for your home, school or community. Sources of energy include windmills, dams, nuclear plants, etc. Food is also a source of energy.

2. Cut out pictures in your newspaper or magazine which illustrate energy sources.

3. Organize your pictures into a poster collage. Show as many sources of energy as possible.

NEXT:

Pick 3 pictures and glue each one on a separate paper. For each one explain:
1. Where the energy source is found.
2. What kinds of energy can be produced from it.
3. Write down examples of the energy being used in everyday living.
4. Pick the one you like the best and present it to the class in a "show and tell".

CAN YOU DO THESE?

1. Explain to the person next to you what our primary source of energy is.

2. Some sources of energy can only be used in particular geographical areas.
   A. Can you name some of these sources?
   B. Why can't these sources be used everywhere?

OVER

3. Circle everything below that is not an energy source. Why isn't it an energy source?

bread
gold
plastic bottle
sunlight
oil
beef
rocks
nuclear reaction
robin
paper
curtain
natural gas
your mother
pinecone
hot springs
house
car
river
coal
wind

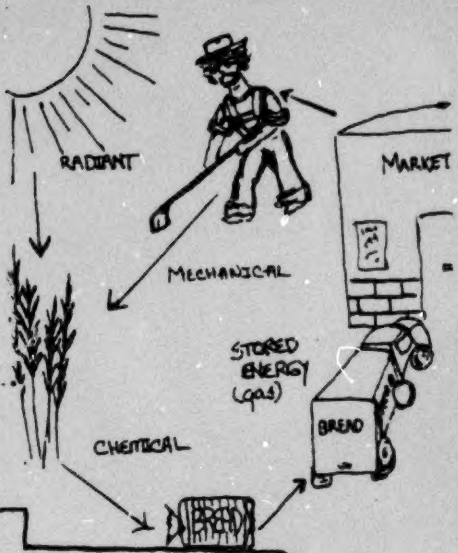
4. You might have found out that almost everything can be a source of energy. Are all energy sources practical to use? Why do you think so?

ON YOUR OWN:

Do you know where the energy used around your house comes from?

D-4

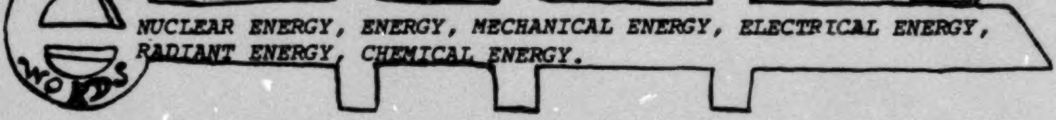
HOW ENERGY IS CHANGED TO MAKE IT USEFUL



BIG IDEAS:

It is hard to trap or store energy. The earth traps energy in coal, natural gas and oil. In order to use this trapped energy it must be converted into a useful form.

YOUR JOB IS: USE THE ENERGY CHART TO SHOW HOW ENERGY IS CHANGED TO MAKE IT USEFUL.



NUCLEAR ENERGY, ENERGY, MECHANICAL ENERGY, ELECTRICAL ENERGY, RADIANT ENERGY, CHEMICAL ENERGY.

NUCLEAR ENERGY - POWER GENERATED BY THE CONVERSION OF ATOMS TO ENERGY.
ENERGY - THE STRENGTH OR POWER TO MAKE THINGS GO AND GROW.
MECHANICAL ENERGY - THE ENERGY OF MOVEMENT.
ELECTRICAL ENERGY - A FORM OF MAGNETIC ENERGY USUALLY TRANSMITTED BY WIRES AND PRODUCED FROM CHEMICALS OR THE MOVEMENT OF WIRES IN A MAGNETIC FIELD.
RADIANT ENERGY - THE ENERGY OF WAVE PHENOMENON FROM THE ACCELERATION OF A CHARGED PARTICLE SUCH AS HEAT, LIGHT,AND RADIO WAVES.
CHEMICAL ENERGY - THE ENERGY RELEASED OR USED UP DURING AN INTERACTION BETWEEN THE ATOMS OF TWO OR MORE SUBSTANCES CONTAINING DIFFERENT AMOUNTS OF ENERGY.

MATERIALS

Sheet of paper
pencil

BEGIN HERE:

All you will need is a sheet of paper and a pencil. We are going to take an imaginary energy trip. As you read the story below, underline any word or words that show energy.

AN ENERGY TRIP STORY

After we start our car, we drive along Seashell Boulevard, the scenic route along the bay. It is a beautiful day! There are many people jogging on Seashell Blvd. today. As we look out into the bay we see the finish of the 25th Grand Admiral sailboat race. The hulls of the sailboat knife through the water. There is a strong breeze. A boat named "Great Lady" is the winner by a nose.

Further up the bay we notice people surfing. One surfer has caught a nice wave. High on the wave, the surfer is pushed closer and closer to the shore. It looks fun; maybe one day I'll try surfing.

Our concentration is broken by the sound of a trolley car passing by. This trolley was one of the first forms of transportation moved by electricity. Let's take a short trolley ride. There's a hotdog stand. Let's stop and get something to eat. As we get off the trolley we notice that the air smells like hotdogs and hamburgers. They are sizzling on the grill. We sit down on a nearby park bench to eat the hotdogs.

Across the road we can see a large farm. It is busy with activity. In the field the cornstalks are very high. In another field, the vegetables look ready to eat. At the far edge of the farm is an old stone building with a water wheel. A beautiful little waterfall is turning the mill. This must be the farmer's old fashioned grain mill. He keeps it for old time's sake.

OVER

The street lights are coming on. We must get back on the trolley. The countryside is a beautiful place to visit. As we enter the edge of our city, we see our car again. The millions of colored lights that are shining remind us that one electrical power plant is supplying enough energy to light our entire city. It has been a fun trip, but it's sure good to be home.

NEXT:

Below is a table to help you understand how energy is changed to make it more useful. In the first column ENERGY ACTION you will find some of the words you might have underlined. Use the table to find out how energy changes occur. Now place your underlined words in the right ENERGY ACTION column box.

HOW ENERGY IS CHANGED TO MAKE IT MORE USEFUL

ENERGY ACTION	Where energy comes from	What energy changes occur	Additional Energy Changes
Sitting down on bench ☞	chemical energy from food	becomes mechanical movement energy/muscular energy	body heat or radiant energy
Waterfall turning mill ☞	radiant energy from the sun stirs the wind and water currents	becomes mechanical movement energy / motion	electrical friction energy comes from generator turned by waterpower
starting a car ☞	chemical energy in battery	becomes electrical energy to start the car	mechanical movement energy and heat energy heat from engine
growing food ☞	radiant heat and light energy from the sun	becomes chemical energy, stimulates the process of growth	chemical energy/new body substances are produced in skin and internal organs
trolley ☞	Uses electrical energy from nuclear energy, burning fuel, water power	electrical energy to move the trolley and light the street lights.	energy for trolley heat energy for trolly lights

CAN YOU DO THESE?

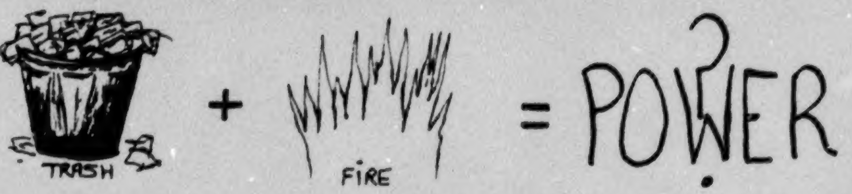
Think of other energy changes not in the story. How do they fit into the Energy Table?

ON YOUR OWN:

Take a walk around your neighborhood. List on a sheet of paper ways you see energy used. When you get home make your own table like the one above. Use the examples of energy you saw on your walk.

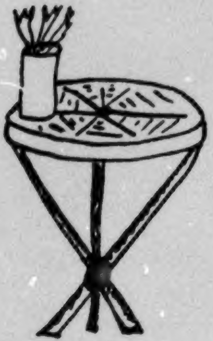
D-5

TRASHPOWER



BIG IDEAS:

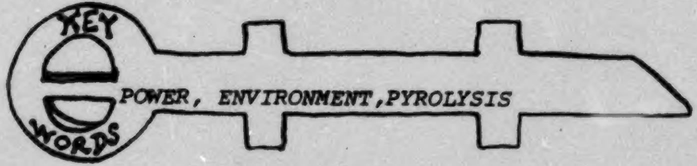
Solid waste can be converted to energy. This reduces the use of fossil fuels such as coal and oil. It also reduces the amount of solid waste that has to be disposed of.



YOUR JOB IS: DECIDE IF YOU THINK SOLID WASTE IS A GOOD FUTURE SOURCE OF ENERGY

Materials Needed

Someone will have to bring in from home;
A bag of trash
An empty trash bag
A portable barbeque grill
An old coffee can - 1 quart of water
A thermometer
A pair of heavy gloves
An electric Hot Plate



POWER - ANY FORM OF ENERGY THAT CAN PERFORM WORK.
ENVIRONMENT - ALL THAT SURROUNDS ANY PARTICULAR COMMUNITY OF PLANTS AND ANIMALS.
PYROLYSIS - TO BURN WITHOUT OXYGEN.

BEGIN HERE: As a class........

1. Ask your teacher to help you obtain a barbeque grill. Be sure to obtain permission from your school principal to operate the grill.

2. Before going on with this lesson do an inventory to make sure you have all the materials needed.

3. Take out the objects in your trashbag that you think are burnable. Put them in the barbeque pit to burn.

4. Fill the coffee can half way with water and place it on top of the grill. Measure the temperature of the water before lighting the fire. Water temperature ___?___.

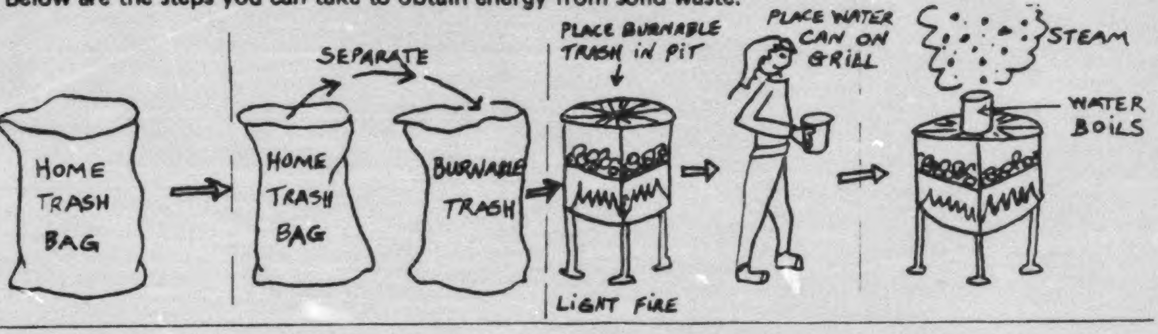
5. Light the fire. Let the solid waste burn. Are there any materials that do not burn? Make a list of them. What materials burn? Make a list.

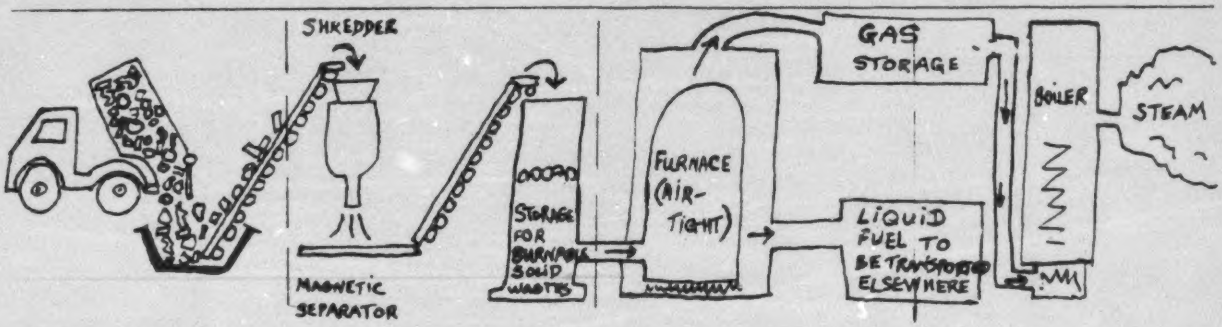
6. When the fire is out use a heavy glove to protect your hand and remove the can of water from the grill. Measure the temperature of the water. Water temperature ___?___.

7. What made the change in water temperature? Was energy converted from one form to another? If yes, what form was the energy first in? What did it change to? How long did it take for the solid waste materials to change to an energy form?

OVER

Below are the steps you can take to obtain energy from solid waste.


HOME TRASH BAG
SEPARATE
HOME TRASH BAG
BURNABLE TRASH
PLACE BURNABLE TRASH IN PIT
LIGHT FIRE
PLACE WATER CAN ON GRILL
STEAM
WATER BOILS


SHREDDER
MAGNETIC SEPARATOR
STORAGE FOR BURNABLE SOLID WASTES
FURNACE (AIR-TIGHT)
GAS STORAGE
LIQUID FUEL TO BE TRANSPORTED ELSEWHERE
BOILER
STEAM

Above is a Diagram which shows the steps taken at a pyrolysis plant to obtain energy from solid waste.

8. Fill the coffee can halfway with cold water again. This time heat it on the electric hot plate.
9. Did energy change? What kind of energy was it? What did it change to?
10. Compare what you did to what happens in a pyrolysis plant. Can you see any similarities? List them.
11. Can you see any differences? List them.
12. What was the end product of your activity? Does your end product compare with the end products from the pyrolysis plant? What is the end product of both diagrams?
13. Discuss in class if you feel burning solid waste to provide energy is easy or economical. Do you think it is a good or bad way to dispose of solid waste? Why?

CAN YOU DO THESE?

Give examples of useful energy which can be converted to steam in a pyrolysis plant.

ON YOUR OWN:

Maybe you will want to write a letter to your town or city council to express your views about solid waste and energy problems.

For more information on energy you can: A) Look in your classroom library science book B) Check out books on energy in your town library C) Write to the: U.S. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

If you are interested in finding out more about using solid waste to provide energy see lesson B 2 and E 4.

D MANY FACES OF ENERGY

AFTER CARRYING OUT THE 5 TASKS IN THIS ENERGY UNIT

THE STUDENT WILL BE ABLE TO:

	Tasks which meet these objectives
1. Define and give examples of the word "energy."	1
2. Identify how energy is used in the home, the school, the community, and in the countryside.	1
3. Identify four groups of energy consumers. Describe how energy is used by them.	2
4. Develop an awareness of where the energy we use comes from.	3
5. Identify the five primary forms of energy.	4
6. Describe how one form of energy is converted to another form to make it useful.	4
7. Define the term "pyrolysis of solid waste."	5
8. Determine the difficulties encountered in using waste materials for energy.	5

GLOSSARY

ENERGY -- The strength or power to make things go and grow.

RADIANT ENERGY -- The energy of wave phenomena from the acceleration of a charged particle.

ELECTRICAL ENERGY -- A form of magnetic energy usually transmitted by wires and produced from chemicals or the movement of wires in magnetic fields.

MECHANICAL ENERGY -- The energy of movement.

CHEMICAL ENERGY -- The energy released or used up during an interaction between the atoms of two or more substances containing different amounts of energy.

NUCLEAR ENERGY -- Power generated by the conversion of atoms to energy.

RESIDENTIAL USE -- Used in the home.

COMMERCIAL USE -- Used in selling our manufactured goods.

INDUSTRIAL USE -- Production operation or activity using labor and materials to produce a product.

TRANSPORTATIONAL USE -- Used for moving from place to place.

ENVIRONMENT -- A collection of things which surround plants and animals, including objects, influences and situations.

PYROLYSIS -- A process to produce a liquid fuel from trash and garbage by heating without oxygen.

TEACHER GUIDE

D-1 ENERGY MAKES THINGS GO

(Can you do these?)

Turn off lights when not in use; use light bulbs with less watts; lower your thermostat, don't take unnecessary trips; use public transportation; car pool when possible.

D-3 WHERE DOES THE ENERGY WE USE COME FROM?

(Can you do these?)

1) Hydro water power - can only be used where there is running water.
   Ocean tides - can only be used where there is a sea coast.
   Geothermal - can only be used where there are hot springs.

2)

Column 1	Column 2	Column 3	Column 4
plastic bottle	rocks	none	house
gold			car

D-4 HOW ENERGY IS CHANGED TO MAKE IT USEFUL

Block 1 = sitting down on bench
joggers running
getting out of car
getting off trolley
driving car

Block 2 = waterfall turning mill
wind blowing sailboat
wave pushing surfer

Block 3 = starting car

Block 4 = growing food

Block 5 = trolley
cooking on stove
street lights
city lights

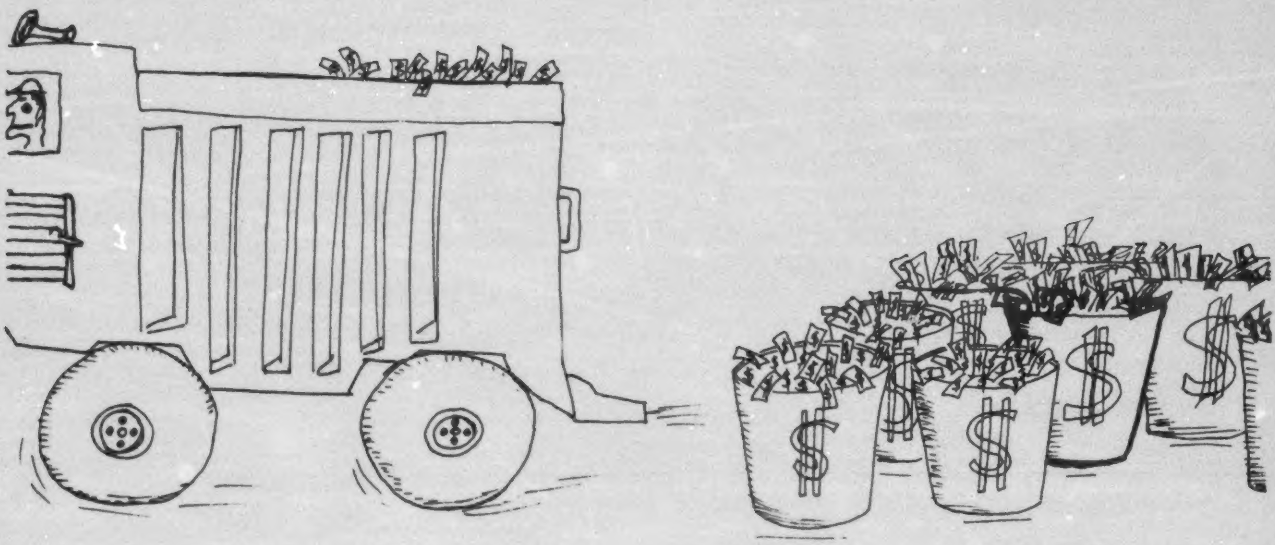
D-5 TRASHPOWER

(Can you do these?)

1) Electric energy - steam to turn the turbines in a generating plant.

2) Heat energy - from burning the oily substance from the pyrolysis process to heat building or industrial processes.

Note: If water temperature does not rise appreciably, repeat using only ¼ of can filled.



"Garbage is only raw material that we're too stupid to use."

Arthur C. Clarke

In 1977, Burlington County spent over 2.5 million dollars for collection and disposal of solid wastes. Why should we be concerned about solid wastes as long as we are willing to pay this high price to hide them?

Our nonrenewable energy and mineral resources are rapidly dwindling. This results in greater transportation, heating and material costs. Simultaneously, current disposal sites are quickly reaching capacity and available land is harder to find. These problems are results of relying on a wasteful approach. We must change our current solid waste management practices soon, before costs become prohibitive.

It is time to stop thinking of solid waste as useless and consider it as the "untapped" resource that it is. Recycling, reuse and energy production from solid wastes can help conserve our valuable natural resources. The time to start is NOW!

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING LESSONS:

E-1. HOW MUCH TO MOVE YOUR TRASH?

SKILLS: Reading comprehension, vocabulary, organizing information, recording data, multiplication, addition, division, problem solving, working independently.

PREPARATION: None

Money is needed for solid waste collection and disposal. The money pays for the drivers, for the purchase and maintenance of trucks, for the gasoline, and for the use of the landfill. In this lesson the students are made aware of how much money it costs to collect and dispose of a community's waste by calculating these costs for several towns.

E-2. CLEANING UP YOUR BLOCK

SKILLS: Reading comprehension, vocabulary, recording observations, measurements, group cooperation, multiplication, division, problem solving.

PREPARATION: None

One of the major costs associated with the solid waste problem today is litter clean up. In this lesson students are made aware of the money required to clean up the litter in an area by laying out a plot, picking up the litter, and computing the costs.

E-3. SCRAMBLED EGGS

SKILLS: Reading comprehension, vocabulary, organizing information, recording observations, measurements, division, multiplication, problem solving, working independently, decision making.

PREPARATION: None

Separating reusable and recyclable solid wastes before they are collected (source separation) can save time and money. In this lesson, students separate recyclable material (glass, paper, cans) from a trashcan, and compute the amount of money their community can save if this method is practiced.

E-4. TURNING TRASH INTO CASH

SKILLS: Reading comprehension, vocabulary, data interpretation, recording data, organizing information, multiplication, division, problem solving, working independently.

PREPARATION: None

Selling solid wastes such as bottles, cans and newspapers can provide money for local communities. This lesson focuses on the economic aspect of recycling solid wastes. The students calculate approximately how much money can be made by their community if it recycled its aluminum, glass, and newspaper.

E-5. GARBAGE POWER

SKILLS: Reading comprehension, vocabulary, organizing information, recording data, multiplication, division, problem solving, interpreting data, working independently.

PREPARATION: None

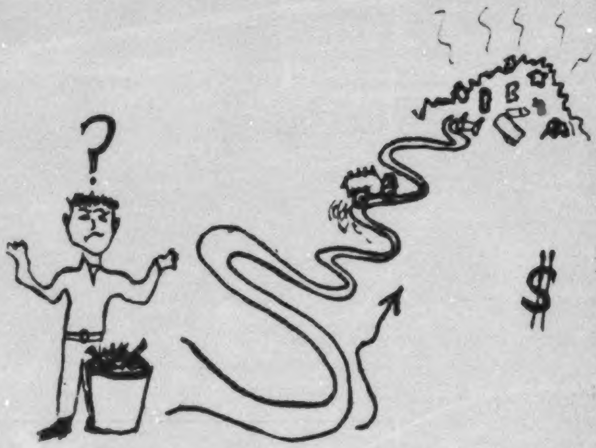
Solid waste can be burned to provide energy for lighting and heating homes and factories. Recycling paper, glass, and aluminum rather than using new resources can conserve great amounts of energy. This lesson allows the students to calculate the amount of coal and oil saved by using solid waste as an alternative energy. It also sheds light on the amount of energy that can be conserved by recycling various forms of solid waste versus using virgin resources.

Each of the lessons can be completed in one 45 minute period, but they can be expanded to 2 - 3 class periods depending on teacher discretion and class interest.

*NOTE: All of the numbers used in this unit can be rounded-off to make the computations easier.

E1

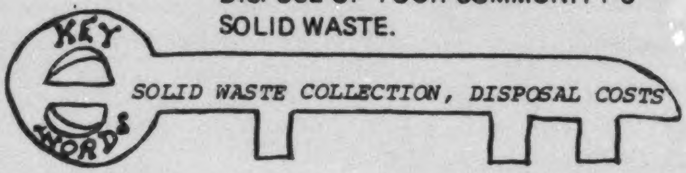
$ HOW MUCH TO MOVE YOUR TRASH? $



BIG IDEA:

The collection and disposal of solid waste costs money. This money pays the drivers, purchases and maintains the trucks,pays for gasoline to move them and pays for using the landfill.

YOUR JOB IS: CALCULATE HOW MUCH MONEY IT COSTS TO COLLECT AND DISPOSE OF YOUR COMMUNITY'S SOLID WASTE.


KEY
WORDS
SOLID WASTE COLLECTION, DISPOSAL COSTS

MATERIALS NEEDED

None

SOLID WASTE COLLECTION - THE ACT OF PICKING UP TRASH AND GARBAGE AND HAULING IT TO LANDFILL OR DISPOSAL SITES.
DISPOSAL COSTS - PUBLIC MONEY PAID TO USE, MANAGE AND MAINTAIN THE LANDFILL.

BEGIN HERE:

Collecting and disposing of garbage costs alot of money. The costs depend on many factors.

These factors include:

1. The type of collection system used. For example, a community may hire a private trash collector or have each family take its own to the landfill.
2. The total number of people who use the collection system. More people make more garbage.
3. The population density. This means how close the people live to each other. The closer they live the easier it is to pick up their garbage.
4. The type and number of trucks used and the distance that they must travel. The more trucks used and the further they must travel increases costs.
5. The number of employees. More workers mean more money spent on wages.
6. How often the garbage is collected. It costs more to collect it twice a week than it does to collect it once a week.

NEXT:

In 1977, the collection of solid waste in Burlington County cost $2,400,904 and its disposal cost $459,670. The total collection and disposal costs were $2,860,574 !* About 362,000 people live in Burlington County. How much does it cost each person to collect and dispose of solid waste? (Hint: Divide the population into the total costs.)

---

* Data from the Solid Waste Management Plan for Burlington County.

OVER

Use the two tables to figure out the annual collection and disposal cost for your community. Do your work on a separate piece of paper. Write the answers in TABLE 1. Do the same thing for four (4) other communities around you.

TABLE 1*

*(Based on 1977 data from the Solid Waste Management Plan for Burlington County, June 1979)

1	2	3	4	5	6	7	8
TOWN	POPULATION	TONS OF SOLID WASTES	COLLECTION COSTS PER TON $	TOTAL COLLECTION COSTS $	DISPOSAL COSTS PER TON $	TOTAL DISPOSAL COSTS $	TOTAL COSTS COLLECTION & DISPOSAL
EXAMPLE		APPROXIMATE	APPROXIMATE	COL. 3 x 4	APPROXIMATE	COL 3x6	COL 5 + 7
Cinnaminson	17641	13795	7.0	96565	0.70	9656.5	106221.5

CAN YOU DO THESE?

1. Why do you think that collection and disposal costs are different for each town?
2. Name 3 factors that influence these costs.
3. Based on the data provided, how many pounds of solid waste does each person in your town produce in one year? (Hint: Divide the population into the tons of solid waste produced in your town in one year. Then divide by 2,000).

ON YOUR OWN:

Discuss with your teacher how disposal and collection costs might be reduced.

To find out more about solid waste disposal methods, see Unit B, "What Happens to What We Throw Away?"

Look up Solid Waste, Garbage, and Trash in an encyclopedia for further information on the subject.

E 2

$CLEANING UP YOUR BLOCK$

BIG IDEAS:

One major cost associated with the solid waste problem is litter clean up. The cost of litter clean up can be cut down by putting garbage and trash in cans, instead of thoughtlessly throwing them on the ground. In New Jersey, in 1970, it cost about 23 cents for each piece of litter picked up by highway crews. This cost is as high as 30 cents now.

YOUR JOB IS: FIGURE OUT HOW MUCH MONEY IT COSTS TO CLEAN UP LITTER.

MATERIALS

TRASHBAGS
TAPE MEASURE

KEY
WORDS
ACRE, AREA, LITTER, TAXPAYERS

ACRE - A SPACE 209 FEET ON EACH SIDE OR 43,560 SQUARE FEET.
AREA - THE SIZE OF ANY FLAT SPACE ON THE GROUND, FLOOR, WALL OR CEILING.
LITTER - TRASH SCATTERED ABOUT INDOOR OR OUTDOORS.
TAXPAYERS - RESIDENTS WHO PAY REAL ESTATE, INCOME OR SALES TAXES.

BEGIN HERE: AS A CLASS DO 1-5

1) Divide into 2 groups. Bring along several trashbags. Measure a litter plot as large as possible with a tape measure. If a tape measure is unavailable you can step-off the boundaries of your plot. Be careful to take normal steps. One normal step equals 2 feet. To find out how many feet you stepped-off multiply the number of steps times 2. (Example: 50 steps times 2 feet per step = 100 ft.)

2) If your school has a large playground each group may pick a plot of one acre. An acre is an area of any shape containing 43,560 square feet (4000 square meters). To make calculations easier measure out only rectangular plots. Places to pick as your litter plot are the schoolyards, parks, sidewalks and curbsides.

3) To find the size of your rectangular plot in square feet you must multiply its length in feet times its width in feet. Example: Size of plot in square feet: PLOT 100 ft. wide 500 ft. long
Area of plot = 500 ft. X 100 ft. = 50,000 square feet.

4) To find out how many acres your plot is, divide your answer in square feet by 43,560 square feet per acre. Example: Size of plot in acres: 50,000 square feet ÷ 43,560 sq. ft. per acre = 1.15 acres.

5) Record your data on the Litter Count and Cost Survey Data Sheet.

OVER

READ AND GO ON:

Now that your litter plot has been measured, slowly walk over the area and pick up any litter you find. Bring along the Litter Count and Cost Survey Data Sheet below.

LITTER COUNT AND COST SURVEY DATA SHEET

Reporter ____________________

Date ____________________

Location of litter plot ____________________

Number of students in your group ____________________

Size of Litter Plot __________ square feet __________ acres

Time Involved to Clean Plot Start __________ Finish __________

Total Number of Litter Pieces Collected ____________________

Find out how much money it would cost to clean your plot. Use the following formula:

> Multiply the total number of pieces of litter times 30 cents. If your group picked up 70 pieces of litter then the total cost in pennies would be 2100 cents.
>
> Example: 70
>
> X 30
>
> How much is this in dollars? 2100 cents
>
> Now find out how much money it would cost to clean an acre plot. Divide the total cost by the size of your plot in acres. If the group above had a 10 acre plot then clean-up costs would be 210 cents per acre.
>
> Example: 2100 ÷ 10 = 210 cents per acre.

Total Cost to clean your litter plot __________ ¢ __________ $ __________

Total Cost Per Acre __________ ¢ __________ $ __________

CAN YOU DO THESE?

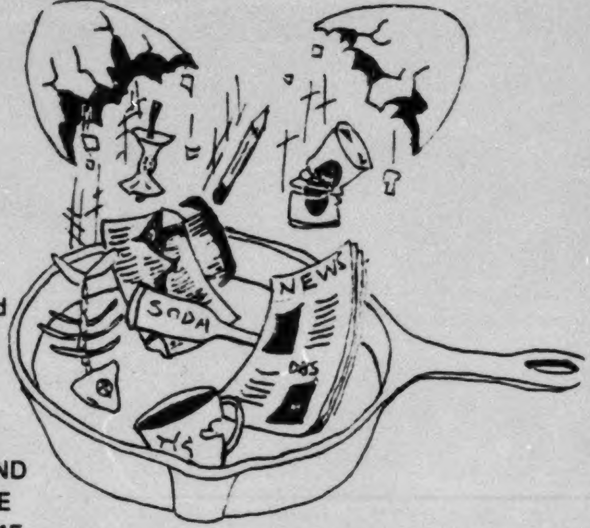
1) Can you think of ways to make litter clean-up less expensive?
2) What is the size of your plot in square meters? (Hint: multiply 4000 square meters per acre times the size of your plot in acres.)

ON YOUR OWN:

1) Do this again on another site. Are your results different?
2) To find out more about litter look it up in an encyclopedia or ask your librarian for books about this subject.

E-3

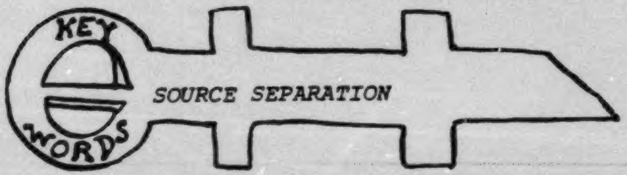
$ SCRAMBLED EGGS $



BIG IDEA:

Separating reusable and recyclable solid wastes before they are collected can save time and money. Time is saved because the materials don't have to be resorted at the recycling plant. Money is saved because the recycling plant does not have to pay people or a machine to resort materials.

YOUR JOB IS: FIGURE OUT HOW MUCH TIME AND MONEY CAN BE SAVED IF PEOPLE SEPARATE SOLID WASTE AT HOME.



SOURCE SEPARATION- THE SEPARATION OF RECYCLABLE AND REUSABLE SOLID WASTE IN THE HOME BEFORE IT IS COLLECTED.

MATERIALS

Ask your teacher for permission, for a student to bring in a bag full of trash or use the classroom trashcan or cafeteria garbage can.

Plastic trash bag

Rubber Gloves

BEGIN HERE:

Have you ever tried to separate the yolk of an egg from the white after you have mixed them together? If it was possible, it would take a long time. The same thing happens when you throw all of your garbage into the same can. Once it is mixed together it is difficult to separate. Some of the material that could have been reused or recycled such as paper or glass would be damaged. The time needed to separate solid waste and the damage caused to the matarials, costs the people money. Wouldn't it make sense for everyone to practice source separation? How much money could the people in your town save if they source separated glass, newspaper and metal at home? To find out read on!

NEXT:

Separate the contents of the trashcan that your teacher has provided. Use rubber gloves. Sort the reusable and recyclable contents into plastic garbage bags.

FOR EXAMPLE: Put all glass into one bag, all paper into another and all metal into another bag. Use the data sheet provided to record your results.

OVER

$ SCRAMBLED EGGS DATA SHEET $

1	TYPE OF TRASH CAN	**Home School Cafeteria Classroom Other**
2	NUMBER OF PEOPLE SEPARATING TRASH	____________________ *Example: 3 students*
3	TIME REQUIRED TO SEPARATE TRASH	______ **minutes** ______ **hours (divide minutes by 60)** *Example: 30 minutes Hours 30 ÷ 60 = .5 hours*
4	COST TO SEPARATE TRASHCAN CONTENTS (1980 minimum wage equals $3.20 per hour)	**Multiply Row 2 times Row 3. Then multiply this answer times the minimum wage** ____________ *Example: STEP 1 3 students x 5 hours = 5 student hours* *STEP 2 $3.20 hour rate x 1.5 student hours = $4.80 Cost*
5	COST PER PERSON PER YEAR Each person fills up about 50 trash cans per year.	**Multiply Row 4 times the number of cans per person per year** ______ $ ______ **per person per year.** *Example: $4.80 per trash can x 50 trashcans per person per year = $240.00 per person per year*
6	POPULATION OF YOUR COMMUNITY	____________________ *Example: 5,000 people*
7	TOTAL POSSIBLE SAVINGS AND TAX REDUCTION FOR YOUR COMMUNITY FROM SOURCE SEPARATION	**Multiply Row 5 times Row 6 $** ____________ *Example: 5,000 people x $240 per person per year = 1,200000 per year*
8	TAX REDUCTION IN YOUR FAMILY	**Multiply Row 5 times the number of people in your family.** **$** ____________ **your family per year.**

CAN YOU DO THESE?

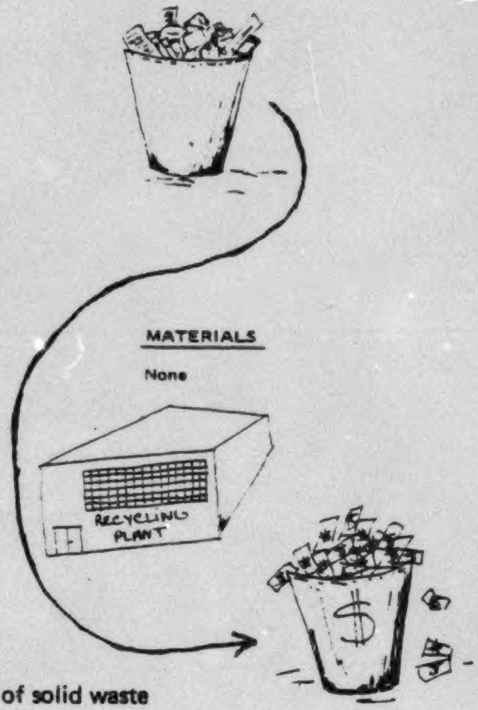
1) How much trash was ruined because the re-usable and recyclable materials were not separated earlier?
2) What are the steps involved in computing the savings of source separation in your community?
3) Based on the results of this lesson, do you think that source separation would be a worthwhile practice for your community?

ON YOUR OWN:

1) Find out if source separation is being planned or practiced in your town.
2) Take a trip with your parents to the town landfill. Ask yourself what materials could have been re-used or recycled. How difficult would it be to "unscramble" this garbage and trash?
3) Do lesson E-4 to see how much money your town could make by selling receivable solid wastes such as glass, newspaper and aluminum cans.
4) For more information on source separation, see lesson C-5

E-4

$ TURNING TRASH INTO CASH $



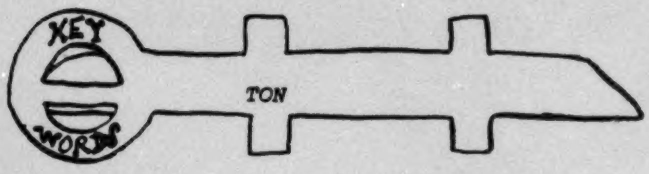
MATERIALS

None

BIG IDEA:

Selling solid wastes such as bottles, cans and newspapers can provide money for local communities.

YOUR JOB IS: FIGURE OUT HOW MUCH MONEY
YOUR COMMUNITY CAN MAKE
IF IT RECYCLES GLASS, ALUMINUM
CANS AND NEWSPAPER.



ton: - A measurement or unit of weight (mass) equal to 2000 pounds or 912 kilograms.

BEGIN HERE:

Each person in the United States throws out about 4 pounds of solid waste every day. This equals almost 1500 pounds per person per year. This includes 15 pounds of aluminum, 125 pounds of glass, and 125 pounds of newspaper. Aluminum, glass and newspaper can be sold to recycling companies or contractors. Table 1 indicates the prices buyers pay for recyclable products. These prices are constantly increasing.

TABLE 1

(1980 prices for recyclable newspaper, glass and aluminum.)

RECYCLABLE PRODUCT	*DOLLARS PER TON*	*DOLLARS PER POUND*	*CENTS PER POUND*
NEWSPAPER	*40*	*.02*	*2*
*GLASS **	*25*	*.0125*	*1.25*
ALUMINUM	*600*	*.30*	*30*

**Delivered to buyer.*

OVER

NEXT:

Let's find out how much money you, your class, and your town can make by recycling newspaper, glass and aluminum. Read on!

Use this chart to find out how much money you can make by recycling. All of the facts you need are in this lesson. Glass has been done for you as an example.
Note: Your figures might be high because not all glass, newspaper and aluminum is recyclable.

TABLE 2

ROW	RECYCLABLE SOLID WASTE	COLUMN 1 pounds/person/year	COLUMN 2 price/pound(¢)	COLUMN 3 total price/year = col 1X2
1	GLASS	125	1.25	125 lbs. X 1.25 ¢ per lb. =156.25 ¢
2	NEWSPAPER			
3	ALUMINUM			
4	Total price per person per year (Add up all the items in column 3 in pennies)			¢
5	Total price in dollars per person per year (divide by 100)			$
6	To find out how much money your class can make in one year multiply the amount in Row 5 X the number of people in your class			$
7	To find out how much your community can make in one year multiply Row 5 X the population of your town.			$

CAN YOU DO THESE?

1) How much money could your state make if it recycled its newspaper, glass, and aluminum? (Hint: find out your state's population).
2) A pile of newspapers folded in half and stacked 32 inches high weighs almost 100 pounds. How much is this worth?
3) A pile of newspapers that fill the space occupied by your family's refrigerator weighs about 1 ton (2000 lbs. / 910kgs.). How much is this worth if it is recycled?
4) Each person uses on the average 400 bottles per year. A community of 20,000 people will use 8,000,000 bottles in a year. This is approximately 5,000,000 pounds of glass !! How much is this worth if it is all recycled?
5) What other items in your community's trash do you think can be recycled? What can be reused?

ON YOUR OWN: 1) If a recycling program is in existence in your town see what you can do to help. If your community does not have a recycling program then you may want to try and set up your own recycling center or see if local organizations such as the Boy Scouts or Girl Scouts can start a program. 2) To learn more about how a recycling center works see lesson G5. 3) For more information on recycling write to : Garden State Paper Company
Park 80 Plaza East
Saddlebrook, N.J. 07662

E-5

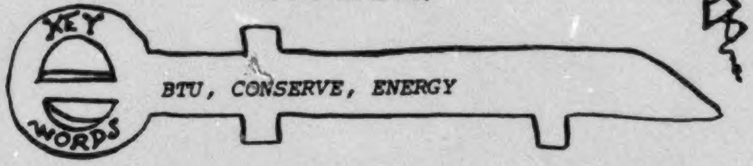
$ GARBAGE POWER $

GARBAGE
POWER
CITY DUMP

BIG IDEAS

Solid waste can be burned to provide energy for lighting and heating homes and factories. Recycling paper, glass and aluminum rather than making new ones can save great amounts of energy as well as natural resources.

YOUR JOB IS: FIGURE OUT HOW MUCH OIL AND COAL CAN BE SAVED BY BURNING AND RECYCLING SOLID WASTE.



MATERIALS

None

__BTU__ - BRITISH THERMAL UNIT - A MEASURE OF THE QUANTITY OF HEAT NEEDED TO RAISE THE TEMPERATURE OF ONE POUND OF WATER (ABOUT 2 CUPS) ONE DEGREE FAHRENHEIT.

__CONSERVE__ - TO USE OR MANAGE SOMETHING (ENERGY) WISELY. FOR EXAMPLE, TO TRY AND GUARD, PROTECT AND KEEP ENERGY IN SAFE SUPPLY.

__ENERGY__ - THE STRENGTH OR POWER TO MAKE THINGS GO. FOR EXAMPLE, TO SUPPLY HEAT AND LIGHT.

BEGIN HERE: Read on

The world's energy supplies (coal,oil,etc.) are quickly being used up. It is important to look for new sources of energy and at the same time conserve what we have left. Garbage can be used to supply energy. A typical pound of solid waste contains 5,000 BTU. Confused? Do you remember what a BTU was? One BTU and one barrel of oil (42 gallons) 5,500,000 BTU!! To find out how much coal and oil your community can save by using its solid waste to make energy complete the GARBAGE POWER WORK SHEET BELOW.

1	Population of your town (round off)	Example: 5000 people ________ people
2	Total amount of solid waste produced in your community daily (Use 4 lbs of waste per person per day)	Multiply 4 pounds times Row 1 Example: 5000 people x 4 pounds per day 20,000 pounds per day ________ POUNDS OF GARBAGE PER DAY
3	Amount of heat (BTU) produced if all the waste was converted to energy (5000 BTU per lb. of waste)	Multiply 5000 BTU per pound times Row 2. Example: 20,000 pounds per day x 5000 BTU per pound 100,000,000 BTU per day ________ BTU per day
4	How many pounds of coal are saved (conserved) daily because solid waste was converted to energy? (12000 BTU per lb. of coal)	Divide 12000 BTU per pound of coal into Row 3. Example: 100,000,000 BTU per day ÷ 12000 BTU per pound of coal = 8333.3 pounds of coal per day. ________ lbs. of coal per day
5	How many barrels of oil are saved daily because solid waste was used to produce energy? (5,500,000 BTU per barrel of oil)	Divide 5,500,000 BTU per barrel of oil into Row 3. Example: 100,000,000 BTU per day ÷ 5,500,000 BTU per barrel = 18.18 barrels per day ________ barrels of oil per day

OVER

READ AND GO ON:

In many cases recycling solid waste materials uses less energy than making products from unused natural resources. How much energy can be saved by recycling aluminum, glass and newspaper? See Table One.

TABLE ONE

MATERIAL	ENERGY (BTU) SAVED WHEN RECYCLING ONE POUND	AMOUNT OF COAL SAVED BY RECYCLING ONE POUND OF MATERIAL (pound)
ALUMINUM	12970 BTU	10 80/100 or 10.8 pounds
GLASS	600 BTU	5 / 100 or .05 pounds
NEWSPAPER	2600 BTU	22/100 or .22 pounds

CAN YOU DO THESE?

1) How much coal can be saved by recycling:

   a) 50 pounds of aluminum?
   b) 50 pounds of glass?
   c) 50 pounds of newspaper?

   (Hint: See Table One)

2) When you used the GARBAGE POWER WORK SHEET you found out how many barrels of oil your community can save each day if it recycled its solid waste. How many barrels can be saved each week? Each year?

ON YOUR OWN:

1) If you would like to learn more about energy, see Unit D.

2) To find out more about recycling, go to your school or county library and ask the librarian for books on this subject.

3) If you are interested in visiting a recycling company see lesson C5.

EVERYONE CAN FIGHT THE SOLID WASTE PROBLEM
YOUR HELP IS NEEDED

WASTEPAPER, METAL AND GLASS ARE WORTH MONEY.

If you studied about solid waste in your school, you have already learned that newspaper, metals and glass can all be sold to recycling companies.

RECYCLING CENTERS ARE GOOD, BUT NOT GOOD ENOUGH.

If you have a recycling center in your town, you know that it depends on people volunteering to bring in recyclable wastes.

Some people bring their materials to the recycling center, but many more do not. Their solid waste goes to the landfill and is lost forever. This is bad because many valuable materials are lost. These materials also take up valuable space in landfills and dumping areas.

THERE IS A BETTER WAY.

Some communities in Burlington County, New Jersey and elsewhere, are asking residents to separate newspapers from other trash. The newspapers will be collected by a private company without cost to the residents. This company will sell the newspapers and pay back some of the money to the community. This not only saves money, but keeps valuable papers from going to the landfill.

WHAT YOU CAN DO.

The separation of newspapers by each family is called "Source Separation". Watch for newspaper stories about Source Separation in your town. Talk to your parents and offer to help put the newspapers on the curb to be picked up.

You can also help to carry waste metals such as cans, and waste glass such as bottles to the nearest recycling center.

If there is no Source Separation for newspapers in your town, you can carry newspapers to a recycling center. Or give them to community groups who raise money by collecting and selling newspapers. Community groups like Boy Scouts who may have conducted recycling activities for years should not be forgotten or ignored by source separation contracts. They may still continue to operate as before.

PLEASE HELP !!

TRASH AND POPULATION STATISTICS FOR BURLINGTON COUNTY COMMUNITIES

TABLE 2*

* (Based on 1977 data-Solid Waste Management Plan for Burlington County 6/79)

TOWN	POPULATION	TONS OF SOLID WASTE	COLLECTION COSTS PER TON ($)	DISPOSAL COSTS PER TON ($)
Bass River Township	1087		27.7	
Beverly City	3215	1136	12.5	2.4
Bordentown City	4740	N/A	N/A	N/A
Bordentown Twp.	7646	5801	17.5	3.3.
Burlington City	11,693	9125	7.8	3.1
Burlington Twp.	11,484	8959	12.0	2.3
Chesterfield Twp.	3521	N/A	N/A	N/A
Cinnaminson Twp.	17,641	13,775	7.0	0.7
Delanco Twp.	3978	3112	10.3	2.0
Delran Twp.	14,483	11,294	9.0	1.6
Eastampton Twp.	3224	2519	15.8	2.8
Edgewater Park	9424	7387	7.4	1.4
Evesham Twp.	18,740	N/A	N/A	24.3
Fieldsboro Borough	585	457	28.2	4.9
Florence Twp.	8768	6867	16.6	2.6
Hainesport Twp.	2797	2268	12.4	2.5
Lumberton Twp.	4924	3847	13.1	2.5
Mansfield Twp.	2758	2155	14.8	1.8
Maple Shade Twp.	22,756	17,773	7.2	1.3
Medford Lakes Borough	6525	5097	5.2	1.0
Medford Twp.	13,008	10,164	13.6	2.6
Moorestown Twp.	15,856	12,386	15.2	4.4.
Mount Holly Twp.	12,869	10,074	3.9	0.7
Mount Laurel Twp.	15,014	11,752	11.3	1.7
New Hanover Twp.	17,082	N/A	N/A	N/A
North Hanover Twp.	9,759	N/A	27.7	N/A
Palmyra Borough	7,599	5,939	14.6	2.4
Pemberton Borough	1,495	1,168	13.8	2.2
Pemberton Twp.	27,114	N/A	27.7	N/A
Riverside Twp.	7,811	6,112	11.0	1.9
Riverton Twp.	3,058	2,392	10.7	4.3
Shamong Twp	2,782	N/A	N/A	N/A
Southampton Twp.	9,548	7,449	5.2	1.0
Springfield Twp.	2,410	1,883	17.7	3.1
Tabernacle Twp.	3,960	N/A	27.7	N/A
Washington Twp.	714	N/A	27.7	N/A
Westampton Twp.	3,067	2,397	14.2	2.6
Willingboro Twp.	43,104	33,757	16.4	2.9
Woodland Twp.	2,258	N/A	27.7	N/A
Wrightstown Borough	2,769	2,163	4.2	1.4

AFTER CARRYING OUT THE 5 TASKS IN THIS CASH 'N TRASH UNIT

THE STUDENTS WILL BE ABLE TO:

	Tasks which meet these objectives
1) Identify 3 factors which influence a community's solid waste collect costs.	1
2) Compute the costs to collect and dispose of the solid waste in their community.	1
3) Compute the cost required to clean up the litter in an area.	2
4) Describe the difficulty and time required to separate recyclable and reuseble materials from solid waste after they have been mixed together.	3
5) Compute the savings to taxpayers if source separation of solid waste is practiced in their community.	3
6) Identify 2 or more types of recyclable solid waste.	4
7) Compute how much money their community could make if it sold its recyclable newspaper, glass and aluminum.	4
8) Compute the amount of oil and gas saved if solid waste is used as a fuel.	5
9) Compute the amount of energy conserved if aluminum, glass and paper are recycled versus using virgin resources.	5

GLOSSARY

ACRE -- A space 209 feet on each side or 43,560 square feet.

AREA -- The size of any flat space on the ground, floor, wall or ceiling, (usually computed length X width).

BTU - BRITISH THERMAL UNIT -- A measure of the quantitiy of heat needed to raise the temperature of one pound of water (approximately 2 cups) one degree Fahrenheit.

CONSERVE -- To use or manage something (energy) wisely. For example; to try and guard, protect, and keep energy in safe supply.

DISPOSAL COSTS -- Public money paid to use, manage and maintain the landfill.

ENERGY -- The strength or power to make things go. For example, to supply heat and light.

LITTER -- Trash scattered about indoors or outdoors.

RECYCLABLE -- Materials, usually trash or garbage, which can be made over to be used in the same or different ways.

RECYCLE -- Taking material from products which are no longer useful and reusing them to make new products.

REUSABLE -- Something which can be used over one or more times.

SOLID WASTE -- Solid materials that have been used and thrown away.

SOLID WASTE COLLECTION -- The act of picking up trash and garbage and hauling it to a landfill or disposal site.

TAXPAYERS -- Residents of an area who pay real estate or income taxes.

TON -- A measurement or unit or weight (mass) equal to 2,000 pounds or 212 kilograms.

TEACHER GUIDE

E-1 HOW MUCH TO MOVE YOUR TRASH?

Each person in Burlington County must contribute $7.90 each year for solid waste collection and disposal.

CAN YOU DO THESE?

1&2. See front page of E-1: Numbers 1- 6;

E-2 CLEANING UP YOUR BLOCK

CAN YOU DO THESE?

1) Volunteer clean-up drives, litter bags for cars, more trash cans.

E-3 SCRAMBLED EGGS

CAN YOU DO THESE?

2) See Scrambled Eggs Data Sheet

E-4 TURNING TRASH INTO CASH

ROW	RECYCLABLE WASTE	COLUMN 1 pounds/person/year	COLUMN 2 ¢ price/pound	COLUMN 3 total price/year
1	Glass	125	1.25	156.25 ¢
2	Newspaper	125	2	300 ¢
3	Aluminum	15	30	450 ¢
4	Total Price per person per year ¢			906.25 ¢
5	Total Price per person per year $			$ 9.06
6	Total Price per class per year $($9.06 x number of students)			$
7	Total Price per community per year $ ($9.06 x population).			$

CAN YOU DO THESE?

1) $9.06 times the population of New Jersey. (approximately $ 65,000,000)
2) $2.00
3) $40.00
4) $62500.00
5) Plastics, other metals, wood, rubber tires.

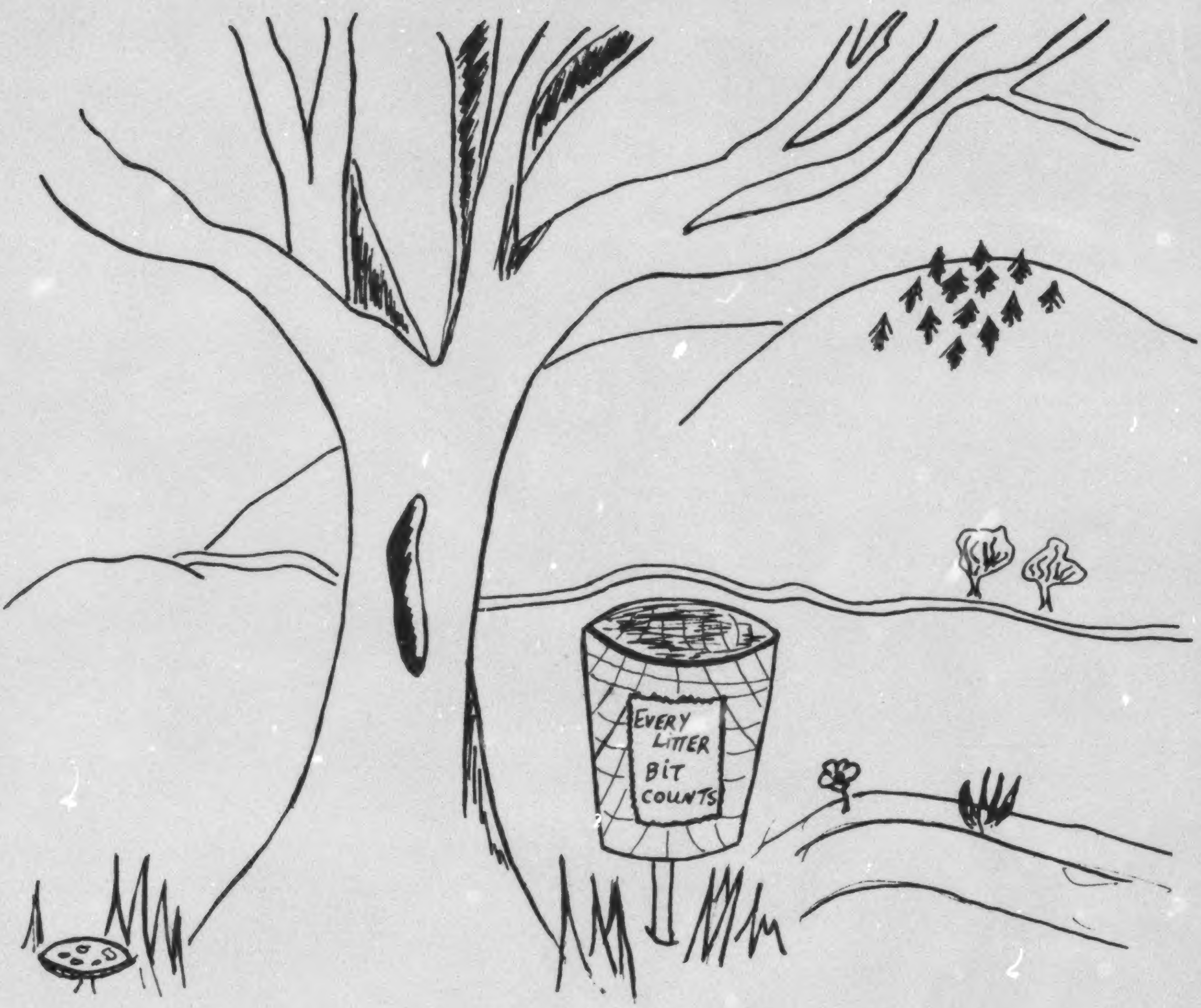
CESC
CETA
5-6

E-5 GARBAGE POWER

CAN YOU DO THESE?

1. a) 54 pounds of coal
   b) 2.5 pounds of coal
   c) 11 pounds of coal

2. To find out how many barrels of oil can be saved in one week, multiply the answer from Row 5 times 7. For one year multiply Row 5 times 365.



OUR VILLAGE WAS HEALTHY AND THERE WAS NO PLACE IN THE COUNTRY POSSESSING SUCH ADVANTAGES NOR HUNTING GROUNDS BETTER THAN THOSE WE HAD IN POSSESSION. IF A PROPHET HAD COME TO OUR VILLAGE IN THOSE DAYS AND TOLD US THAT THE THINGS WERE TO TAKE PLACE WHICH HAVE SINCE COME TO PASS, NONE OF OUR PEOPLE WOULD HAVE BELIEVED HIM.

BLACK HAWK
CHIEF OF THE SAUX AND FOX

Litter is one aspect of the solid waste problem that everyone can do something about. Preventing litter can save money and help keep the environment clean and healthy. Public awareness through the activities and efforts of concerned citizens is one of the first steps in eradicating litter from the environment.

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING ACTIVITIES:

F-1 MAKE TRASH LIVE AGAIN

PREPARATION: None

SKILLS: Reading comprehension, vocabulary, recording observations, organizing information, group cooperation, decision making, values clarification, sketching, art construction.

The modern home is one of the main sources of solid waste. It is a good place to help solve solid waste problems. In this lesson the students may examine and discuss ways they can reduce the production of solid waste in their homes.

F-2 START A LITTER CAMPAIGN

PREPARATION: None

SKILLS: Reading comprehension, vocabulary, Group cooperation organizing activities, leadership abilities, poster-making, letter writing.

A litter campaign to prevent and reduce litter in a particular area is a good way to bring public attention to the litter problem. In this lesson the students will learn what steps they can take to launch a litter campaign. Accessory activities to help the campaign are covered in lessons F-3, F-4, F-5.

F-3 LEARNING TO SEE LITTER

PREPARATION: None

SKILLS: Reading comprehension, vocabulary, organizing and recording information, group cooperation, creative writing, decision making, values clarification.

Litter is all around us. People are not always aware of the litter until they stop and look for it. In this lesson the students will make a survey of litter in a particular area. They will decide which litter is biodegradable and which is not to illustrate which litter will remain the longest in the environment if it is not removed. They may use this survey as a basis for the litter campaign in lesson F-2.

F-4 TAKING PICTURES FOR A LITTER CAMPAIGN

PREPARATION: Do lesson F-2, Obtain Cameras & Film

SKILLS: Reading comprehension, vocabulary, photography, organizing information, working independently,

Photography is a good way to bring litter problems to the attention of many people. This can be one of the first steps in solving litter problems. The pictures produced from this lesson may aid the students in the litter campaign described in lesson F-2.

F-5 WRITE LETTERS FOR A LITTER CAMPAIGN

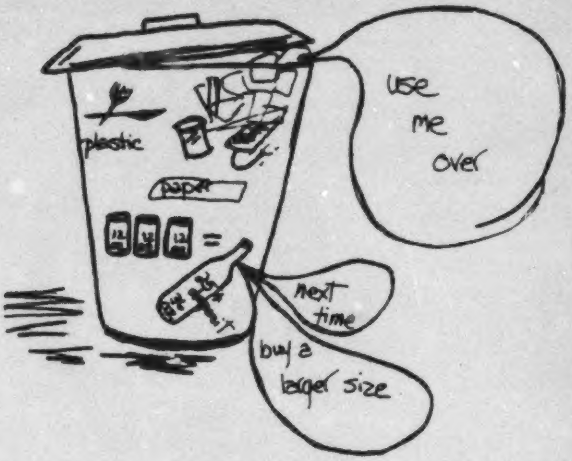
PREPARATION: Lesson F-2

SKILLS: Reading comprehension, vocabulary, letter writing, group cooperation, organizing information, decision making, values clarification.

Well written and directed letters about a specific problem often get results and responses. In this lesson the students learn to write a formal letter about litter problems and the effort of their litter campaign. These letters may be accompanied by the photographs taken in lesson F-4.

NOTE: The above activities may be completed in succession as an anti-litter project or campaign; however the lessons may also be completed separately or in another order.

F-1 MAKE TRASH LIVE AGAIN



BIG IDEA:

The modern home is one of the main sources of solid waste. It is a good place to begin solving the problem of how to reduce the amount of waste generated. This can be done by conservation.

YOUR JOB IS: EXPLORE WAYS TO LESSEN THE AMOUNT OF SOLID WASTES PRODUCED IN YOUR HOME.

KEY WORDS
CONSERVATION, DISPOSABLE

MATERIALS

Poster paper, Glue
Tacks, Scissors

CONSERVATION- THE SAFEKEEPING OF NATURAL RESOURCES FOR FUTURE GENERATIONS OR TIMES OF NEED.

DISPOSABLE- ITEMS WHICH ARE MADE TO BE USED ONCE AND THEN THROWN AWAY. EXAMPLES ARE DISPOSABLE DIAPERS, CIGARETTE LIGHTERS AND PAPER PLATES.

BEGIN HERE:

Have a family discussion about ways to cut down on solid waste.

1) Reduce the numbers of disposable containers you buy.
2) Stop using paper plates and cups.
3) Take cloth or plastic shopping bags to the supermarket.
4) Use permanent cloth napkins and dish towels instead of paper.
5) Use returnable bottles.
6) Use aluminum foil 2 - 3 times instead of just once.
7) Challenge your family to think of more.

NEXT:

Make a home bulletin board to show how many items could have a second lives or other uses.
(see the back of this page.)

Ask your teacher to let you combine ideas with other students to make a larger class bulletin board.

Examples of materials which may have a second use are:

Plastic containers
Milk cartons
Metal cans
Bottles

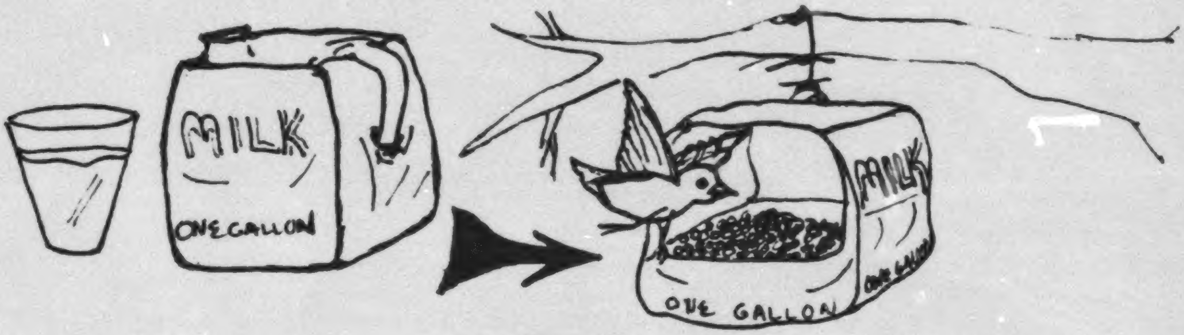
OVER

SOLID WASTE CONSERVATION BULLETIN BOARD

Solid waste items	Ways to reduce the waste of this item	Substitutes for the item	Ways to reuse item

Activity 3:

You can make weather instruments, flower pots or bird houses from milk cartons. Old tires can be converted to ornamental flower pots or even hammocks.



CAN YOU DO THESE?

1. Write down 2 glass products you can think of that could have been purchased in a reusable form.
2. Describe 2 paper products you found that could have been recycled or reused instead of thrown out.
3. Draw 2 food scraps that could have been composted or fed to birds in a birdfeeder made out of trash (see drawing).
4. Name 3 permanant products that could have replaced disposable ones.

ON YOUR OWN:

1. Find discarded articles you can repair and make use of.
2. Collect deposit bottles and cash them in. (To see how much oil you can save by recycling bottles, cans and paper do lesson E-5.)
3. For more information about how much it costs to collect and dispose of your family's garbage see E-1.

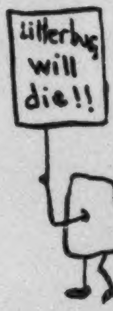
F-2 START A LITTER CAMPAIGN

BIG IDEA:

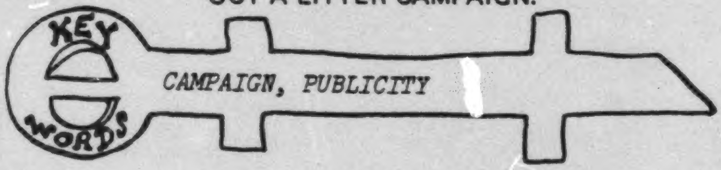
A litter campaign to prevent and reduce litter in a particular area is a good way to bring public attention to the litter problem.

Boycott Litter

ANTI-Litter !


litterbug will die!!

YOUR JOB IS: ORGANIZE AND CARRY OUT A LITTER CAMPAIGN.



MATERIALS

Town map, poster paper, litter containers

DON'T BE A LITTER BUG!!

CAMPAIGN- A SERIES OF OPERATIONS OR ACTIVITIES WHICH ARE DESIGNED TO BRING ABOUT A PARTICULAR RESULT.
PUBLICITY- WAYS TO ATTRACT PUBLIC ATTENTION.

BEGIN HERE:

Ideas for starting a litter campaign:

A) Find a place to make a litter survey. (see lesson F-3).

B) Make posters for the campaign.

C) Talk about and select ways to appeal to children younger than yourself, older students, and adults such as service clubs, businesses, and public agencies.

D) Design and distribute bumper stickers.

E) Make a large wall sketch or chart to show all of the different phases of your litter campaign and who or what groups will carry them out.

F) Choose a good name or slogan for your campaign.

G) To have an effective campaign against litter in your town you will need many groups working together.

One or more groups will be needed to:

- clean up selected areas with much litter.
- set up posters
- continue publicity in newspapers or on local radio about the progress or success of the anti-litter campaign
- obtain and set out more litter containers in places where there are not enough, such as recreational areas and ball fields.
- make sure that the new litter containers are emptied regularly.

OVER

ON YOUR OWN:

1. Refer back to lesson E-2 and estimate how much it would cost the state of New Jersey to clean up one of your litter sites.

2. In E-4 you can get an idea of how much the litter around you is worth if it is recycled.

3. For more information you can write to: the U.S. Environmental Protection Agency
Region 2, Solid Waste Section
26 Federal Plaza
New York, NY 10007

New Jersey is conducting a litter campaign, Write: Governor's Anti Litter Campaign
Office of the Governor
Trenton, NJ 08625

NEXT:

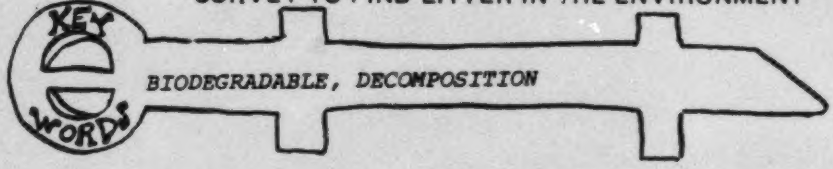
Go on to lessons F-3, F-4 and F-5 to help start the campaign.

F-3 LEARNING TO SEE LITTER

BIG IDEA:

Litter is all around us. People are not always aware of the litter until they stop and look for it. Litter that is not biodegradable and cannot be decomposed will last much longer in the environment than biodegradable litter.

YOUR JOB IS: CONDUCT A HOME, SCHOOL OR COMMUNITY SURVEY TO FIND LITTER IN THE ENVIRONMENT



BIODEGRADABLE- MATERIALS WHICH CAN BE BROKEN DOWN BY ORGANISMS FOUND IN NATURE.
DECOMPOSITION - THE BREAKDOWN OF MATERIALS INTO SIMPLER PARTS OR COMPOUNDS.

BEGIN HERE:

1. Survey one of the following: School, neighborhood, your yard, part of your town. Try to pick an area with alot of litter.
2. Draw a chart like the one on the reverse side to record the location and the kinds of litter you found.
3. After identifying and categorizing the types of litter you found on your chart, look for signs of decomposition, if any.
4. Discuss with your classmates and teacher the possibilities of cleaning up one of your areas. You can photograph your area before and after it has been cleaned up. (see F-4).
5. After you have completed your chart, discuss the following questions with your class.

   A. Why is one type of litter found more often than others?
   B. Were most of the litter items you found biodegradable?
   C. Make a list of the different reasons why you think people litter.
   D. What is the source of each litter item? (Where was it purchased?)
   E. Was it thrown from a car or dropped by someone walking?

OVER

LITTER SURVEY CHART

Locations	Kind (s) of Litter	Will the litter decompose?	How long will it last in the environment?

CAN YOU DO THESE: ?

1. Make a list to show how many littered places you saw in one week.
2. Write a paragraph to show how you feel about a littered place.

ON YOUR OWN:

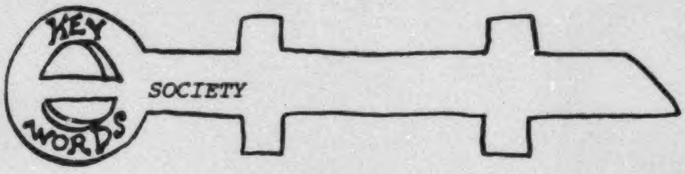
1. Start a collection of newspaper and magazine clippings on litter and solid waste in your state. Bring these articles to school and share them with your class.
2. To find more information about litter look up this subject in an encyclopedia or ask your librarian for books on this topic.
3. Discuss your feelings about litter with your family. Make a list of ideas on how to prevent and reduce litter problems.

F-4 TAKE PICTURES FOR YOUR LITTER CAMPAIGN

BIG IDEAS:

In today's society, many people have the idea "out of sight, out of mind." Through inexpensive modern photography, litter problems can be brought to the attention of many people. This publicity may inspire involvement from people who can help the campaign.

YOUR JOB IS: PHOTOGRAPH A LITTERED AREA BEFORE AND AFTER A LITTER CAMPAIGN AND CLEAN-UP.



SOCIETY- A COMMUNITY OF PEOPLE REGARDED AS A SEPARATE GROUP BECAUSE OF THEIR GOALS, VALUES, LIFESTYLES AND STANDARDS OF LIVING.

BEGIN HERE:

Along with a litter campaign and letter writing efforts, pictures of your litter survey sites will add to your effort by making citizens and community leaders aware of the problems.

HERE ARE SOME IDEAS:

1. Photos of an unsightly nearby dump may be compared to those of a well managed landfill.
2. Photos of a littered lot may be compared to a clean field.
3. Candid photos of the rear of stores and industries could make owners aware and prompt them to clean it up.
4. Before and after photos of the litter site surveyed in Lesson F-3 can illustrate your litter clean-up efforts.

NEXT:

After you have finished taking your photographs; pin them up on the classroom bulletin board. Write captions underneath them to tell what they describe and what actions were taken, if any.

ON YOUR OWN:

1. You may like to take pictures of the school trip suggested in task card B-1.
2. You may want to submit some of your creative pictures to a photo contest.
3. Other "before and after" shots might be of interest to a local newspaper.
4. To learn more about photography go to your school or local library and take out books on the subject.
5. Go on to lesson F-5 "Writing Letters For A Litter Campaign."

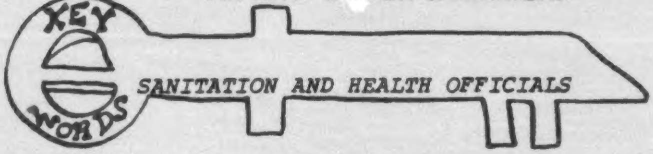
F-5 WRITE LETTERS FOR A LITTER CAMPAIGN

US Mail
"Anti-litter Campaign"

BIG IDEAS:

The pen is mightier than the sword. Well written letters sent to the right places often get dramatic results and responses. Letters are also necessary to maintain good communication between social groups or individual people.

YOUR JOB IS: WRITE LETTERS DESCRIBING THE ENVIRONMENTAL DAMAGES CAUSED BY LITTER AND LAUNCH AN ANTI-LITTER CAMPAIGN.



SANITATION AND HEALTH OFFICIALS- PEOPLE WHO WORK TO PROTECT THE QUALITY OF THE ENVIRONMENT FROM DISEASE AND POLLUTION.

BEGIN HERE: Divide into three groups

Group 1 Write to the editors of your school newspaper, the P.T.A. bulletin and daily or weekly newspapers in the area.

Group 2 Write letters to government officials such as the Mayor, the county freeholder director, assemblymen,senators and the governor of your state.

Here are some ideas:

Governor
State Capital
City, State, zip

Senators
Senate Office Building
Washington, DC 20510

Congressmen

Mayor
Town Hall
(Your Town, NJ)

OVER

Group 3 Send letters to local sanitation and health officials requesting their advice and aid in hauling the litter you have gathered to a suitable dump.

Board of Health
Your Town,NJ

Town Council
Town Hall
Your Town, NJ

Govenor's Anti - Litter Campaign
State of New Jersey
Office of the Governor
Trenton, NJ 08600

TOPICS TO DISCUSS IN YOUR LETTERS:

1. Purpose of your litter campaign.
2. Location of your litter survey.
3. Advice or support on materials you require from them.
4. Enclose pictures to document your campaign if possible.

To find out how to write a formal letter ask your teacher for help

Keep copies of each letter you send and of the dates they were sent on - Record all responses.

CAN YOU DO THESE?

1. Did your letters obtain responses? Why or w hy not?
2. Did the responses, if any, help you in your litter campaign? Why or why not?

F

ECO-ACTION

AFTER CARRYING OUT THE 5 TASKS IN THIS ECO-ACTION UNIT
THE STUDENTS WILL BE ABLE TO:

	Task which meets these objectives
1. Use the family unit as an action group for reducing the volume of trash produced by the family.	1
2. Communicate with their own families about social problems.	1
3. Increase public awareness of litter in the community.	2, 3, 4, 5
4. Engage in a personal effort to reduce the litter in a chosen area.	2, 3, 4, 5
5. Plan an action campaign, specifically, an anti - litter campaign in the community.	2, 3, 4, 5,
6. Increase their ability to communicate with people in various segments of society by letter writing.	5
7. Write letters to motivate people to societal actions.	5
8. Use photographs as a medium for description.	4

SOLID WASTE/ENERGY CURRICULUM

TEACHER BRIEFS

For Teachers of Grades 7, 8, 9

INFORMATION JUST FOR YOU!

- - *Why Teach About Solid Wastes?*
- - *How To Use This Curriculum Special Features*
- - *What About?*
  - - *The Big Ideas*
  - - *Evaluation*
  - - *Grade Level Placement*
  - - *Answers to Questions and Numerical Problems*
- - *Getting Energy From Trash and Garbage*
- - *Landfilling*
- - *County Multi-municipal Source Separation Program*
- - *Hazardous Wastes*

CONSERVATION AND ENVIRONMENTAL STUDIES CENTER, INC.

120-13 Whitesbog Road

Browns Mills, New Jersey 08015

Produced by a grant from Burlington County CETA

2311 Burlington-Mt. Holly Road

Burlington, New Jersey 08016

INFORMATION JUST FOR YOU

WHY TEACH ABOUT SOLID WASTES?

The specter of hazardous wastes frightens every community. We are all having more and more trouble throwing things away. Each year there is actually more to put in the waste can; and each year there seems to be less space available for disposal. Surprising amounts of energy are spent or lost with our present means of getting rid of wastes. The disposal of solid wastes is the hottest environmental problem today.

Here are some reasons why you might want to share some learning experiences about trash and garbage with your kids.

Landfills are closing up; we're running out of landfill space.

Trash/garbage collection costs more and more, taking an increasingly larger tax bite.

Hazardous wastes are the focus of the latest scam by organized crime .

Everybody comes in contact with solid wastes daily.

There are excellent opportunities for drills with basic skills:

mathematics - measurement, drill and data interpretation

group leadership and interaction

language arts - spelling, writing,reports, giving oral reports to peers and adults, letter writing, vocabulary and using library and other research techniques.

art - murals, posters, sketches, plays, skits, songs

values consideration - exploring the values of self and others

HOW TO USE THE CESC/CETA SOLID WASTE CURRICULUM SPECIAL FEATURES

You may be weary of seeing new curriculums and even when you like them, wonder how you could possibly add anything more. Here's the good news about this curriculum:

You may plagiarize. You may save paper and money by photocopying any or all activities as you please.

It's designed as a take-it-or-leave-it curriculum. You may use as few as one lesson/activity or as many as you like. It's open ended.

It is multi-disciplinary, can be related to various studies; it's interdisciplinary in many activities; the subject matter boundaries are broken down.

You may conduct field trips at your own school or your community,

WHAT ABOUT ? ? ?

The Big Ideas

The prime learning objectives are prominently displayed as "The Big Ideas." If you would like your students to develop these generalizations on their own (by induction), you may block out the "Big Ideas" so that they won't appear in the photocopies.

Evaluation

One successful kind of evaluation is that in which the teachers are satisfied that objectives have been achieved. Each objective is keyed to one or more activities which should, if successfully carried out, provide evidence for the achievement of an objective. The many products of these activities, data pages, oral and written reports, drawings and murals are chief sources of evidence.

The section called "On Your Own" is not only intended to be a profitable set of follow up activities. These activities also lend themselves as an evaluation tool.

Answers To Questions and Numerical Problems

You will find answers for all questions on pages 3 or 4 of the unit folder which is your special unit teacher's guide.

Grade Level Placement/What Activities For What Grade Level?

If the activities included in any grade level cluster present a problem, you'll have to deal with it by agreement in any school or "district wide" as you choose. Certainly you will want to avoid the deadening effect of "we did this last year." You will probably want to divide the activities among or between the grades.

It seems best to leave the choice to you especially since with classes of younsters with varying abilities, interests, and curricular freedoms, you may even wish to utilize activities from a different grade level cluster.

INFORMATION JUST FOR YOU

GETTING ENERGY FROM TRASH AND GARBAGE

This information applies to

Grades 5-6, B-3 "Garbage to Soil", C-5 "Visiting a Recycling Center," D-5 "Trash Power," E-5 "Garbage Power." Grades 7, 8, and 9, D-4 "We Used Garbage For Energy."

–Part of the answer to America's power shortage may be found in a dump. This practice of getting energy from trash is rapidly becoming reality. Garbage and trash, especially the organic portion, will burn. Mixed municipal solid waste is mostly composed of combustible materials, i.e. paper, plastic. More than 90% of the volume of mixed municipal solid waste can be eliminated by incineration.

–In a total resource recovery operation everything going into the waste stream, whether organic or inorganic, would become a usable "product", such as fuel, fertilizer , steam, electricity, or other salable material. Both in this country and abroad, modern pollution-controlled incinerators are using garbage and trash to produce steam. When unseparated municipal refuse is burned heats about half as well as coal. This steam is then used either directly to provide building heat or indirectly to drive steam turbines that produce electricity. In addition to burning the organic part of refuse as a substitute for other fuels, garbage and trash can be converted into storable fuels.

–Instead of being burned, waste may also be placed in a closed chamber and baked at high temperatures in the absence of oxygen, thereby reducing the volume by about 90 percent. This form of incineration is known as "Pyrolysis", and may bring us even closer to a state of "zero waste growth.

–Besides being a source of heat and power, organic refuse has other uses. One of these other uses is composting. Composting utilizes both bacterial and chemical processes to convert organic wastes into soil conditioners that can enrich gardens and farmlands. It is one of the oldest and most familiar forms of resource recovery. Until recently, composting has been used mainly by home gardeners.

–Municipal composting is more common in Europe where there are few land sites for waste disposal. It was hoped that a profitable business of producing compost could be started in the United States Composting has not yet become well established in this country because there are many other sources of less expensive chemical fertilizers. The costs of separating and transporting compost to the point of use are high. However, we must also consider the benefits of composting in terms of health, cleanliness and resource conservation as well as the cost of alternative methods of disposal, before we dismiss composting as being uneconomical.

–With the demand for electric power increasing each decade, these ways to obtain heat and power from organic refuse are important additions to our energy that was required to take it away from the environment in the first place.

–To have value, materials must be recovered from refuse on a large scale basis. Before this can happen, answers must be found to the complex questions of costs, potential markets and public attitudes in order to develop a lasting solution. In the United States there is growing public concern about the problem of solid waste and a sincere desire to face the challenge.

LANDFILLING

This information applies to:

Grades 5-6, B-1 "Open Dumps and Sanitary Landfills," Grades 7,8,9 B-1 "Introducing the Sanitary Landfills."

Here is some pertinent information on landfills which you may find to be informative and helpful in assisting children to work on these activities.

–The landfilling of waste materials dates back to very early times. It is one of the oldest waste disposal techniques used by modern man, short of illegal or open dumping. It is still the least expensive waste disposal practice in current use.

–During the last four decades, solid waste disposal techniques in a landfill (or what used to be called a dump) have been greatly improved to minimize environmental damage, and is now termed "Sanitary Landfilling." It can be both environmentally sound and economically competitive. However, one of the important problems with landfill operations is the fact that so many are not managed efficiently or with maximum environmental safeguards.

–Sanitary landfilling is a process where refuse is spread, compacted and covered with soil in a prescribed manner to a depth of twenty-four or more inches. These techniques, when managed properly, minimize environmental degradation while trying to maximize the effective use of available land.

–When solid wastes are put into a landfill, degradation takes place as a result of various chemical and biological reactions. This degradation process produces solid, liquid and gaseous by-products The principal gases generated are carbon dioxide and methane.

–Carbon dioxide is water soluble and can be absorbed into the ground water. Upon entering the groundwater, carbon dioxide lowers the pH (or increases the acidity level), thereby magnifying its corrosiveness.

–Methane is relatively insoluble in water and, because of its lightness or low density, it will migrate

vertically or laterally through the refuse into the atmosphere or surrounding areas. Methane gas is both explosive and toxic. It is toxic in the sense that anyone entering a room or chamber filled with methane would suffocate from a lack of oxygen.

--As rain water or ground water percolates through a landfill, it becomes contaminated with water soluble products from the solid wastes or their decomposition. This escaping water, with its additional dissolved or suspended matter is called leachate. It can migrate from a landfill and directly affect the quality of ground and /or surface water nearby.

--To maximize environmental protection, hydrological and geological investigations are necessary before the site of a sanitary landfill is chosen. These investigations will determine whether the earth at the site is compact enough to prevent the leachate from entering the ground water. A surface and ground water quality monitoring program in conjunction with an impervious substrate or foundation are management techniques and site qualities which a desirable potential landfill site should have. The following methods should also be utilized to maximize environmental protection A) leachate collection and testing B) capping with twenty-four inches of soil, C) methane gas control, and D) monitoring the drainage basins where leachate collects.

--The failure to adhere to these protective measures leads to the dangerous states of contamination which have recently been so alarming to the general public.

SOURCE SEPARATION AND RECYCLING

THE PROPOSED MULTI-MUNICIPAL SOURCE SEPARATION RECYCLING PROGRAM FOR BURLINGTON COUNTY

This information applies to:

Grades 3-4, B-2 "Recycling Relay Game," Grades 5-6, Unit C (all activities) Grades 7, 8, and 9, D-2 "What If We Source Separate?" D-3 "What If We Recycle Steel, Aluminum, and Glass?

The volume of municipal solid waste generated in New Jersey each day is of sufficient volume to fill Giants Stadium every two weeks.

As solid waste management problems have become increasingly evident, methods have been sought to mitigate the negative aspects of "garbage." Planners have sought to develop measures that would both lower the volumes of materials going to landfills, as well as put that particular material to a subsequent use. Recycling of material such as newspapers, glass and metals performs both of these functions.

Under New Jersey Public Law 1975, Chapter 326, entitled the New Jersey Solid Waste Management Act, each county and the Hackensack Meadowlands Development Commission were designated as solid waste management districts. Under the Act, each district is responsible for developing and implementing plans which provide for the "maximum practicable use of resource recovery strategies" (i.e., recycling).

The Burlington County Office of Waste Management Programs, situated within the County Health Department, has developed an implementation plan for a two-year pilot program in curbside collection of source separated newspaper. Source separation programs are a major component of the overall resource recovery strategy identified in the Burlington County District Solid Waste Management Plan, recently adopted by the Board of Chosen Freeholders. The source separation plan sets forth a comprehensive program whereby a private contractor will provide curbside collection of used newspaper on a bi-weekly basis throughout the Townships of Cinnaminson, Delran, Moorestown and Willingboro. The contractor will not be paid by the participating townships or the County for this service, but instead is expected to offset his capital and operating costs and receive a reasonable rate of return on his investment through revenues generated from the scale of the recovered newspapers.

Scout troops, charitable organizations, and individual scavengers will be able to continue their operations with only minor changes to their present collection methods. In fact, recent studies indicate that such groups thrive when coexisting with a formalized municipal program.

The proposed program is designed to be basically self-supporting (not requiring a subsidy through the use of tax-payers' money) and will provide a savings to the individual townships. These savings can appear as: 1) rebates from the newspaper collector based on tonnage of newspaper recovered. 2) Rebates from the mixed-refuse collection in townships with contracted garbage collection systems or in the case of townships with their own regular garbage collection systems direct cost savings are encountered through the decreased volume of waste physically collected by them. 3) Rebates from savings encountered by re-routing regular garbage collection vehicles in a more energy efficient manner by taking advantage of less regular waste found at each collection stop. 4) reduced disposal costs due to less material to be landfilled; and 5) conservation of scarce and costly landfill capacity. With each ton of newspaper recycled, three cubic yards of landfill space is conserved and seventeen trees from our valuable forest lands need not be cut down for their pulp value. In addition, 60% to 70% less energy is utilized in producing new pulp products from recycled paper, versus virgin wood pulp.

Oil is not the only imported material which is having an impact on the United States trade deficit and contributing to the current inflationary spiral. Numerous raw materials used in manufacturing processes are imported into the U.S. Many of these raw materials are presently in the municipal waste stream and could be recycled to produce an economically attractive domestic supply. New newsprint is one example. Implementation of newspaper source separation programs similar to the one proposed will help alleviate the U.S. dependence on imported newsprint. At the same time, this effort will also foster the strength and expansion of recycling industries which contribute significant primary manufacturing strength to the New Jersey economy through jobs and ratables. The proposed recycling program should afford the resident an opportunity to effectuate a change in historically wasteful and environmentally damaging solid waste management trends.

Present projections call for the initiation of the proposed source separation newspaper recycling program in April 1981.

* Adopted from the descriptive text developed by Burlington County Office of Solid Waste Management Program.

HAZARDOUS WASTES

This information applies to:

Grades 7, 8, and 9, C-1 "Hazardous Waste Is . . .", C-3 "Hazardous Wastes: Harmful or Healthy?"

Hazardous wastes are discarded materials that pose a substantial threat to human health or the environment when improperly handled for disposal.

Every year billions of tons of solid wastes are discarded in the United States. These wastes can come from common household trash, industrial wastes, sewage sludge, agricultural residues, mining refuse, military operations and pathological wastes from institutions such as hospitals, and laboratories.

Hazardous wastes generally come from discarded industrial products and are often in the class of substances popularly referred to as chemicals. Spent materials from nuclear reactors are also very hazardous when discarded.

These wastes can be in the form of solids, liquids, sludges or gases in pressurized containers They differ from other solid wastes in that they have one or more of the following characteristics; ignitable, reactive, toxic, corrosive, infectious or radioactive.

The U.S. Environmental Protection Agency (E.P.A.) estimates that in 1980 at least 57 million metric tons of the nation's total wastes load can be classified as being hazardous. Some hazardous wastes are eventually neutralized chemically by decomposition or oxidation in the soil and air at their disposal sites. Others may not break down and thus remain dangerous indefinitely. Unfortunately, many dangerous wastes that society has thrown away over the recent decades have remained unchanged and are now leaking from corroded containers. They often leak into the earth and ground water from which fresh water supplies are pumped.

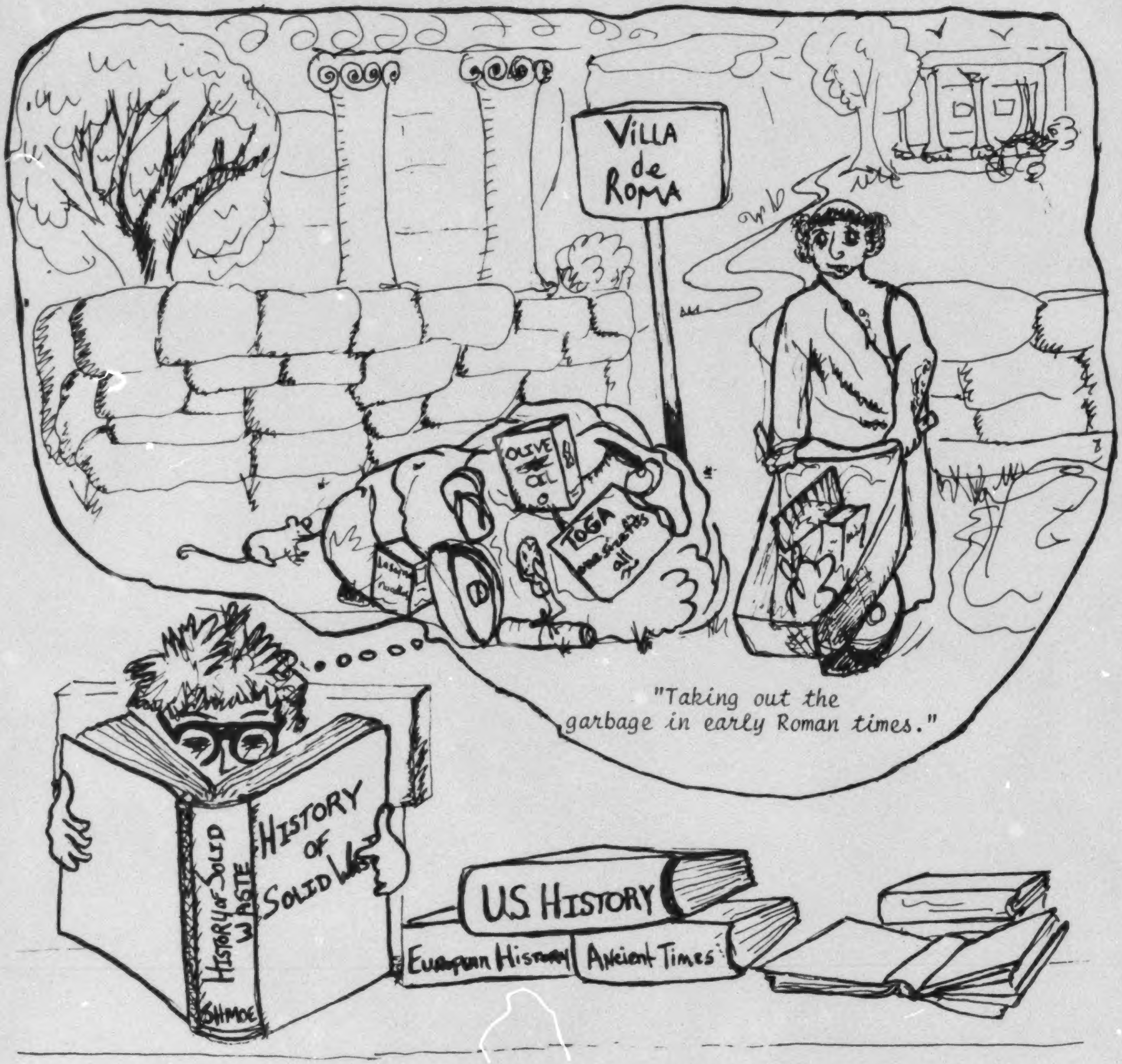
Hazardous wastes may cause or significantly contribute to serious illness or death. They can poison, burn, maim, blind and kill living organisms. They can affect the human nervous system, internal organs and skin disorders, cancer and birth defects. Sometimes their effects can be felt immediately after exposure; at other times they may not show up for weeks, months or years. Many do not break down in the environment.

The U.S. Surgeon General has described the problem of hazardous waste disposal as a "major public health concern" that will plague the nation for years. Although more stringent disposal rules have been adoped, the improper handling and disposal of hazardous wastes has continued unabated. Tighter rules may have led to recent increases in illegal disposing.

Because of the intense publicity and shocking effects of hazardous wastes on human health and because more and more hazardous wastes were being located in 1980, a great public outcry was raised. Victims or those who perceived themselves as threatened, vigorously demanded aid and financial reparations from chemical industries and the state, and federal governments.

In December 1980 President Carter signed a "Superfund Bill" into law requiring the chemical industry to contribute toward the clean up of chemical spills and abandoned waste disposal sites. This was a scaled-down version of the original bill which had been the subject of frantic compromising during the closing hours of the 96th Congress.

The revenue which the bill generates covers a special tax to be levied by the chemical industry with the larger remainder to be taken from general taxes. The bill offers no reimbursement for individual citizens affected by toxic wastes; it offers no coverage for oil spill damage. However, it represents a first step toward relieving the growing hazard of toxic chemicals seeping into the nation's land and waters. Many industries are now lobbying to place more of the clean-up cost burden on the public, both through federal subsidies and direct sales charges.


VILLA de ROMA
OLIVE OIL
TOGA
"Taking out the garbage in early Roman times."
HISTORY OF SOLID WASTE
HISTORY OF SOLID WASTE
SHMOE
U.S. HISTORY
European History
Ancient Times

"The proper disposal of waste is one of our urgent national problems."

Imogene B. Oakley
Ladies Home Journal
November 1919

Refuse or solid waste dumping grounds are characteristic of all human civilizations. The most important clues to the past life and times of older civilizations are found in the contents of their dumping grounds. Many cities of ancient times were built atop the rubble and dumps of previous cities.

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING LESSONS:

A - 1. DIGGING UP THE PAST

PREPARATION: NONE

SKILLS: Reading comprehension, vocabulary, creative writing, sketching.

Solid waste dumping grounds are a characteristic of all human settlements. Archeologists use old dumping grounds as a "link to the past" through which they can learn about ancient civilizations. In this lesson the students will discover how they can learn about a civilization by digging in an imaginary dump.

A - 2. ASK SOMEONE WHO REMEMBERS

PREPARATION: Arrange for an elderly person to visit the class.

SKILLS: Reading, vocabulary, organizing information, recording observations, writing reports, interviewing, values clarification, evaluation of information.

Until the early 20th century possessions were treasured and handed down to succeeding generations as family heirlooms. With the onset of mass production many materials made today are designed to have a limited lifetime. In this lesson the students will interview an elderly person about the value they placed on material goods in their generation and on the quality of goods manufactured in the past. They will compare these views with present attitudes on products.

A - 3. VISITING AN ANTIQUE SHOW

PREPARATION: Find an antique store or show in your area.

SKILLS: Reading, vocabulary, recording observations, research techniques, working independently.

A major difference between the solid wastes of 100 years ago to those of the present is in their composition. In this lesson the students will visit an antique show to identify the differences between material goods produced in the past and those produced today.

A - 4. A DAY IN THE LIFE OF

PREPARATION: NONE

SKILLS: Reading comprehension, vocabulary, mural and poster making, organizing information, library skills, research techniques, leadership abilities.

Lifestyles, which have changed since the Industrial Revolution, have had an important effect on the composition and amount of solid waste people produce. In this lesson students will research various lifestyles from the 1800's to the 2000's and relate them to the generation of solid wastes by drawing murals of people in their daily lives.

A - 5. 1980's: WHAT LIES AHEAD ?

PREPARATION: NONE

SKILLS: Reading comprehension, vocabulary, evaluation and criticism of writing, organizing information, creative writing.

Much of the world's energy resources and raw materials are rapidly dwindling. Many other resources that remain in abundant supply are limited in their availability due to political, economic and environmental restrictions. In this lesson the students will examine and discuss the problems of energy and resource shortages by making a bulletin board of magazine and newspaper clippings. They will discuss the use of solid wastes as a means of energy production and resource conservation.

Some of the lessons in this unit require out of class time and others will require 2 or more class periods for completion.

A1 DIGGING UP THE PAST

BIG IDEAS:

Refuse or solid waste dumping grounds are a characteristic of all human settlements.

The most important clues to the past life and times of older civilizations may be found in the contents of their dumping grounds.

YOUR JOB IS: PERFORM AN IMAGINARY "ARCHEOLOGICAL DIG" OF THE FUTURE.

KEY WORDS

ARCHEOLOGICAL DIG, POTSHERD, SOLID WASTE, STRATIGRAPHIC COLUMN

ARCHEOLOGICAL DIG - AN AREA WHERE PEOPLE STUDY PAST HISTORY OR PRE-HISTORY. THEY CAN DIG INTO THE EARTH TO FIND TRACES OF EARLIER CIVILIZATIONS.

POTSHERD - A PIECE OR FRAGMENT OF BROKEN POTTERY.

SOLID WASTE - MATERIALS, SOLID IN COMPOSITION, THAT HAVE BEEN USED AND THROWN AWAY.

STRATIGRAPHIC COLUMN - A HISTORICAL OR SOCIOLOGICAL SERIES OF LAYERS WHICH REPRESENT SEVERAL STAGES OF HUMAN DEVELOPMENT.

BEGIN HERE:

Read the following excerpt taken from a National Geographic magazine in which an archeologist describes the value of solid wastes discarded by people of ancient civilizations.

> *"If an Indian woman broke a pot, swept it up swearing under her breath, and threw the pieces in a depression where erosion would not move them, she had started what we archeologists call a stratigraphic column. More breaking and sweeping, and more debris piled on as decades passed-eventually several feet of material, largely returned to the soil from which it came.*
>
> *Ninety-nine times out of a hundred, the sherds at the bottom of the column will be different from those on top. Pottery fashions and techniques change, slowly but inexorably, and furnish major clues toward the prehistory we are trying to write...we could watch, in effect, the Indian women perfect their ceramic art. We found a growing sophistication, both in the decorations and in the shape of the pots themselves."*[1]

NEXT:

As you can see, there is much information that archeologists can discover by digging and studying solid wastes left behind by ancient civilizations. Read the following excerpts taken from National Geographic magazine articles which describe two archeological digs and try to answer the questions that follow.

1) *"For the first several feet our dig produced mainly pieces of broken pottery, or potsherds, and cracked and broken bones of deer, bear, raccoon, turkey, and turtle - the scrapings and utensils from hundreds of primitive meals. The cave man wasted no food."*[2]

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[1] Douglas Osborne, "Solving the Riddles of Wetherill Mesa," National Geographic, 125, No. 2 (1964), 155-196.

[2] Carl F. Miller, "Life 8,000 Years Ago Uncovered in an Alabama Cave," The National Geographic Magazine, cx, No.4 (1956), 542-558.

OVER

QUESTION: Describe the differences in materials found in the first few feet of the archeological dig to what would be found in the first few feet of a modern sanitary landfill. What events through history brought about these changes?

2) *"Since we found no agricultural implements... we surmised he [the Alabama cave man] did not grow any of his food. His sole sources of supply must have been hunting, fishing, and gathering of wild grain, nuts, and fruits."* [2]

QUESTION: Archeologists assume that the Alabama cave men were completely dependent upon their surrounding environment. Inasmuch as these people probably lived in stable settlements, what assumptions can you make about the environment in which they lived?

3) *"We found no trace of cotton plants. Yet the Anasazi Indian did leave behind cotton textiles. This can only mean that* ______________________."[2]

QUESTION: Can you complete the above statement?

4) *" Fires were built in holes in the cave floor...The cave dwellers ate around the fire, and when they finished gnawing the bones, they threw them untidily on the floor."* [2]

QUESTION: How does this scenario compare with present day people sitting at a roadside picnic table? If these things are true, how respectful were people of these older cultures of their environment?

5) *"Eventually the debris from old fires and last month's meals grew too strong for even primitive housewives, and they carried in quantities of earth and covered it all up, laying a clean new floor."* [2]

QUESTION: The sanitary landfill methods of the last few years have been suggested as being relatively new techniques. What differences are there between the landfills of today and several thousand years earlier? Have the materials that are being dumped changed over the past few thousand years? If so, how?

CAN YOU DO THIS?

Imagine that you are an archeologist of the future. You have been selected to perform an archeological dig in your old home town. As you walk down the streets of your town, now deserted, you recognize the house where you once lived. Since you are aware that old dumps contain the most important clues to the past life and times of older civilizations, you decide to find the town's landfill and dig there.

Draw a time scale diagram. Describe what you might find from the year 1900 to the year 2000. It may be helpful for you to break this time period into 20 year intervals. 1900-1920, 1920-1940, 1940-1960, etc. . .What types of artifacts would you find in these time periods? *(An example of a "Time Scale Diagram" can be found in magazine article No.2 of footnotes.)*

BEGIN YOUR DIG:

Using your imagination, describe the events and findings of the dig.

1) "Find" at least one artifact for each twenty year period.
   Example:
   1900 - 1920 — wood furniture, old glass bottles
   1920 - 1940 — farm tools, canning jars
   1940 - 1960 — manual typewriters, auto tires
   1960 - 1980 — Aluminum cans plastic bottles
   1980 - 2000— ?
2) Draw a picture of each artifact that you "find".
3) What assumptions can you make about the people that once lived here?
   Example: 1920 - 1940 — people apparently did much farming. Ladies canned their foods at home.
4) You may want to use the following factors as a guideline for each time period:
   1) Life styles
   2) Eating habits
   3) Clothes
   4) Concern for environment
   5) Technology
   6) (Think of more on your own)

A2 ASK SOMEONE WHO REMEMBERS

"They sure don't make 'em like they used to..."

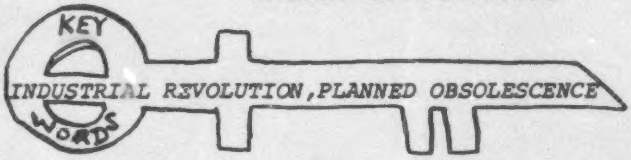
BIG IDEAS:

Until the early 20th Century household goods, or possessions were treasured and handed down to succeeding generations as family heirlooms.

"Conservation", the wise use of natural resources, was extended to the care and use of all manufactured goods until the 20th Century.

Most of the products made today are designed to last for a planned limited time period. This is known as planned obsolescence.

YOUR JOB IS: TO INTERVIEW YOUR GRANDPARENTS OR ANY PERSON IN THAT AGE GROUP ABOUT THE WORTH OR VALUE PLACED ON MATERIAL GOODS OF THEIR GENERATION, AND DISCOVER IF THESE VALUES HAVE CHANGED.



INDUSTRIAL REVOLUTION - A SERIES OF CHANGES WHICH TOOK PLACE IN THE METHODS OF PRODUCTION DURING THE EIGHTEENTH CENTURY, i.e. THE INVENTION OF THE STEAM ENGINE, AND ITS USE AS A SOURCE OF POWER AND THE RISE OF MASS PRODUCTION GOODS.

PLANNED OBSOLESCENCE -PRODUCTS WHICH ARE DESIGNED OR PLANNED TO LAST FOR A LIMITED TIME SUCH AS CLOTHES, AUTOMOBILES AND MANY APPLIANCES.

BEGIN HERE:

1. Prepare a list of questions to ask them dealing with subjects such as;
   a) Were people more appreciative of their possessions or belongings during the earlier part of the century than they are now?
   b) Were family possessions like furniture,china, appliances and clothes passed on from one generation to another?
   Think of more questions on your own.

2. Prepare a list of questions dealing with the durability and quality of products manufactured during the earlier part of the century. Below are a few examples:

   What is your opinion on the quality of goods made today?
   Is there a difference in quality between the products of today and those of the past?
   Were past products more durable than today's?
   Were past products made so they could be repaired easily? How about those of today?
   Did people take care of their belongings or possessions so that they would last as long as possible? More than they do now?
   Think of more questions on your own.

OVER

3. While you are conducting the interview, record all of the responses to your questions.
4. Based on the answers to your questions write a short story describing the change, if any, in the values people place on their belongings. Are people returning to the conservation ethic once expressed during the earlier part of the century? If so, why?

NEXT:

Try to locate a family heirloom and find out something about its history. Why has it been kept all of this time? What is it made out of?

CAN YOU DO THIS?

1. Make a list of all of the disposable items in your home, i.e. things that are made to be used and then thrown away. Perhaps you could convince your family to stop buying these disposable items and change to a product that will last, or can be made to last.

A3 VISITING AN ANTIQUE SHOW

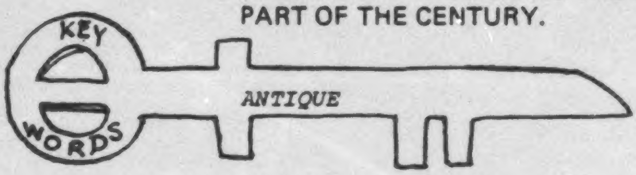
ANTIQUE SHOW

BIG IDEAS:

One major difference between the solid wastes of 100 years ago and those of the present is in their composition; for example, materials such as nylon, plastic and aluminum were either unheard of or extremely rare.

The solid wastes produced by mankind today, such as plastics, are not as readily returnable to earth as they once were; that is, the wastes are not as readily decomposed in the soil.

YOUR JOB IS: VISIT A LOCAL ANTIQUE SHOW TO EXAMINE THE COMPOSITION OF THE PRODUCTS MADE DURING THE EARLY PART OF THE CENTURY.



Materials needed: None

ANTIQUE - *AN ANCIENT OR OLD RELIC OF THE PAST.*

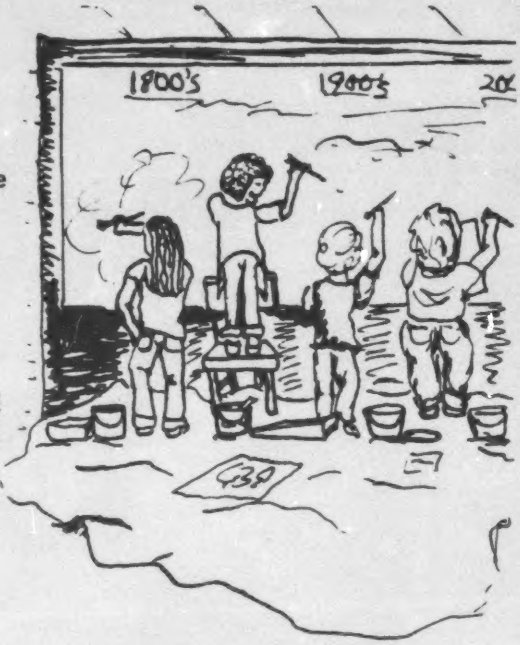
BEGIN HERE:

1. Check your local newspapers to find an antique show coming to your area.
2. If an antique show is not available, visit an antique shop, second hand furniture dealer, or a flea market.
3. While looking at the antiques pay particular attention to the materials with which they are made and answer the following questions.
    - a) What are some of the materials used to make the antique articles?
    - b) Do you think that many of the items made today will someday be displayed as antiques?
    - c) List some materials made today that you did not see at the antique show.
4. Choose an antique that interests you, and compare it to a similar item made and used today.
    - a) In what way has it changed?
    - b) How long do you think it was made to last?
    - c) If the antique was made to last, why was it?
5. Do you think the people of the future will find more solid wastes from the present civilization than we have found from ancient civilizations, e.g. Aztec and Maya Indians? If so, why?
    - a) What do you think will be left behind by today's society that could be found in a few thousand years?
    - b) Do you think solid wastes from present day society might be harmful to future civilizations on earth? e.g. radioactive wastes.
    - c) Are the solid wastes of past civilizations harmful to us? If yes; how?

NEXT

Go to task card A1 and study the types of solid wastes produced by ancient civilizations.

A4 A DAY IN THE LIFE OF



BIG IDEAS:

The Industrial Revolution of the mid 19th Century signaled the change from an agriculturally based lifestyle to one based on industry and technology.

Lifestyles have an important effect on the composition and amounts of solid waste people produce.

YOUR JOB IS: DESIGN AND DRAW MURALS WHICH DESCRIBE A DAY IN THE LIFE OF A TYPICAL AMERICAN FROM THE 1800's, THE 1900's & THE 2000's. RELATE YOUR MURAL TO SOLID WASTE GENERATION.

KEY
WORDS
LIFESTYLE

LIFESTYLE - A MEANS TO DESCRIBE THE WORKING, PLAYING, AND FAMILY HABITS OF A FAMILY OR AN INDIVIDUAL.

MATERIALS NEEDED:

Paper
Pens
Paint
Paint brushes

BEGIN HERE:

Divide yourselves into 3 groups. Group 1 will take the 1800's, Group 2 – 1900's; and Group 3 – 2000's. Before executing a major project like a wall mural you must:

1) Decide exactly what you want to describe.
2) Research the subject.
3) Plan and design the mural on paper.

To get started with research on lifestyles, consult your classroom history text, encyclopedias, and books dealing with the colonization of America, the Revolutionary War, and the American Pioneer. If there is a historical museum nearby, make arrangements to visit it.

Factors to look for in your research include;

- Water sources
- Food sources
- Types of shelters
- Access to stores
- Types of materials people would throw away.
- Types of work done by the people studied
- Type of area; ex: agricultural, urban, industrial
- Leisure activities such as dancing, bingo, music, movies, etc.

Group 3: Use your imagination!

When you have completed your draft drawings you are ready to start. Pick a wall in your classroom or, with the permission of your teacher and principal, use a hallway wall. Tack up rolled drawing paper to cover the wall.

Each group is responsible for the subject, design and execution of their own mural.

Try to include as much detail as possible.

Relate the daily activities to the generation of solid wastes.

OVER

If your mural is a success your school might let you draw it directly onto the wall.

Ask another class to judge your murals on the basis of:

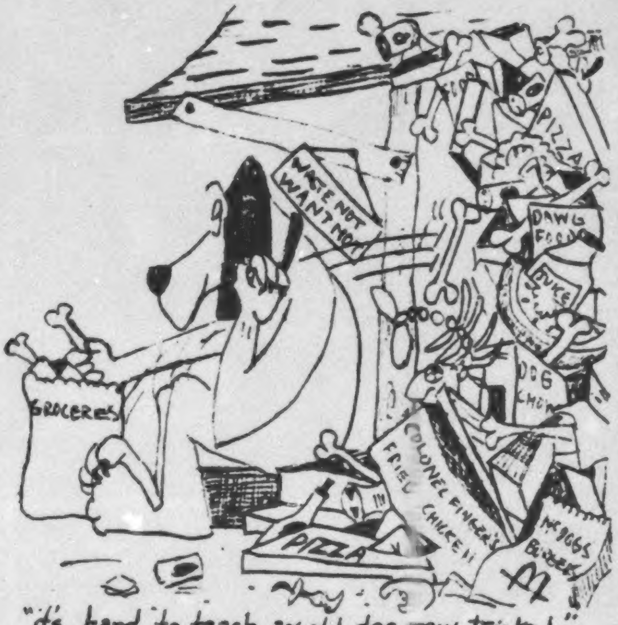
1) Originality
2) Amount of detail
3) Most well done
4) Most realistic

ON YOUR OWN:

Draw a poster, depicting your own daily activities and compare it to the murals of the past and future. What are the differences in the solid waste you produce.

A5

1980's WHAT LIES AHEAD



"it's hard to teach an old dog new tricks!"

BIG IDEAS:

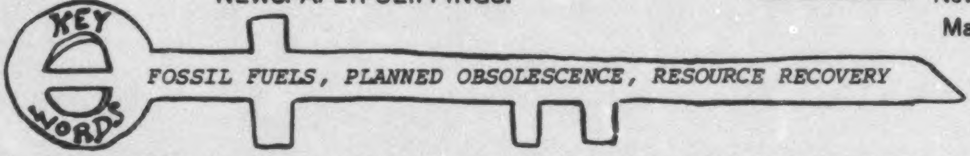
The world's supply of fossil fuels are quickly being used up. This makes it important to practice energy conservation and to seek new sources of energy.

Many natural resources remain in abundant supply. However, some countries have more than others. Political, economic, energy and environmental limitations reduce their availability.

Resource recovery (energy production, reuse, recycling) of solid wastes can help conserve our precious remaining natural resources.

YOUR JOB IS: MAKE A BULLETIN BOARD FROM MAGAZINE AND NEWSPAPER CLIPPINGS.

MATERIALS: Newspaper & Magazines


KEY WORDS
FOSSIL FUELS, PLANNED OBSOLESCENCE, RESOURCE RECOVERY

FOSSIL FUELS - FUELS WHICH WERE ONCE PLANTS OR ANIMALS CENTURIES AGO. THEY ARE USED FOR HEATING AND GENERATING POWER. COAL AND OIL ARE EXAMPLES.

PLANNED OBSOLESCENCE - PRODUCTS WHICH ARE DESIGNED OR PLANNED TO LAST FOR A LIMITED TIME SUCH AS CLOTHES, AUTOMOBILES, AND MANY APPLIANCES.

RESOURCE RECOVERY - THE PROCESS USED TO OBTAIN ENERGY OR MATERIALS FROM SOLID WASTE.

BEGIN HERE:

No one has to tell you we live in a changing world. Until recently most of us probably never thought very much about energy. Today, we can't turn on the radio or television or read a newspaper without hearing something about this worldwide problem.

Around the globe events take place daily that affect the way we live, work and play. The thermostats in our homes and schools are set at lower temperatures, skyrocketing gasoline prices limit our travel, and the increased cost of food has limited our buying power. Quite simply, our lifestyles have changed dramatically in the last five years. Why?

Previously, money was the only limit a person had to the amount or quality of a product he could purchase. Now however, many items that we want and use are in limited supply or not available at all. Many of the world's energy resources and raw materials are rapidly dwindling. Improved technology and increased population has resulted in increased consumption of raw materials and energy. In the past, low prices and abundant supplies resulted in a throw-away society. Seventy percent of all metal is used only once and discarded. In 1977, Americans used 20 billion square feet of aluminum foil and 24 billion aluminum cans. Almost all of the foil and 18 billion of the cans were thrown away. By force of habit most of what we use today is still thrown away. As the saying goes: *It's hard to teach an old dog new tricks.*

OVER

Packaging of both perishable and nonperishable items has increased in the last ten years; further increasing the consumption of raw materials and adding to the waste load.

Planned obsolescence is common in many industries. In the clothing industry, for example, manufacturers predict what colors and styles will be popular in the upcoming seasons. As a result, the public purchases new clothes that are "in" and discards most of the old apparel.

For many materials no world shortages yet exist. However, their supply may be limited by political, energy, economic, and environmental restrictions. The world's mineral resources are distributed unevenly. Certain countries have a large share of valuable natural resources that many other countries need. An example is the vast oil supply located in the Middle East. Political relationships largely determine the cost and availability of these resources to buyers. In addition, the mining of coal and other minerals may be expensive, energy consuming, and damaging to the environment.

Solid wastes, long regarded as useless and worthless materials, may help conserve our natural resources. Many valuable materials are contained in solid wastes. By extracting these usable materials we can reclaim wealth from waste. This reclamation of materials is known as Resource Recovery. It includes the energy production, reuse and recycling of solid waste.

NEXT:

There are no simple solutions to these complex problems. To make effective decisions we must be kept informed. Cut out articles from magazines and newspapers that deal with today's solid waste problem. Make a bulletin board in the back of your room and place the articles under the several appropriate headings; ENERGY, ENVIRONMENTAL IMPACTS, RESOURCE RECOVERY, and MISCELLANEOUS.

CAN YOU DO THESE?

1. Who wrote the article you selected? What type of group or company is represented? Does the article seem biased or one-sided? If yes; why do you think so?

2. What restrictions can you identify in your article? (e.g. political, economic, environmental, scarcity, energy, location.)

3. What kinds of resource recovery practices have you read about? Have they been successful? Why or why not?

ON YOUR OWN:

1. Spread the word. Organize a group of students or the entire class. Write a school Environmental Newsletter containing information that you gathered and include an editorial section to voice your personal views.

A SOLID WASTE IN HISTORY

AFTER CARRYING OUT THE 5 TASKS IN THIS HISTORY UNIT THE STUDENTS WILL BE ABLE TO:

	TASKS WHICH MEET THESE OBJECTIVES
1. Discover how old dumps can provide clues to ancient civilizations.	1
2. Identify what types of materials might be found in a dump from the present civilization.	1
3. Identify the values placed on material goods by people of the previous generation.	2
4. Compare these values to those of today's generation.	2
5. Compare the differences between the material composition of products made 100 years ago and those of today.	3
6. Discover the relationship between lifestyles and the materials people throw away.	4
7. Identify changes in lifestyles from before the Industrial Revolution to after the Industrial Revolution.	4
8. Identify 2 or more factors which influence the availability and supply of the world's natural resources.	5
9. Describe at least 2 ways in which the use of solid wastes can relieve the shortages of natural resources.	5

GLOSSARY

FOSSIL FUELS - FUELS WHICH WERE ONCE PLANTS OR ANIMALS CENTURIES AGO. THEY ARE USED FOR GENERATING POWER AND HEAT. EXAMPLES OF FOSSIL FUELS ARE COAL AND OIL.

PLANNED OBSOLESCENCE - PRODUCTS WHICH ARE DESIGNED OR PLANNED TO LAST FOR A LIMITED TIME SUCH AS CLOTHES, AUTOMOBILES, AND MANY APPLIANCES.

POTSHERD - A PIECE OR FRAGMENT OF BROKEN POTTERY.

RESOURCE RECOVERY - THE PROCESS USED TO OBTAIN ENERGY OR MATERIALS FROM SOLID WASTE.

SOLID WASTE - MATERIALS, SOLID IN COMPOSITION, THAT HAVE BEEN USED AND THROWN AWAY.

STRATIGRAPHIC COLUMN - A HISTORICAL OR SOCIOLOGICAL SERIES OF LAYERS WHICH REPRESENT SEVERAL STAGES OF HUMAN DEVELOPMENT.

TEACHER GUIDE

A-1 DIGGING UP THE PAST
(Next)

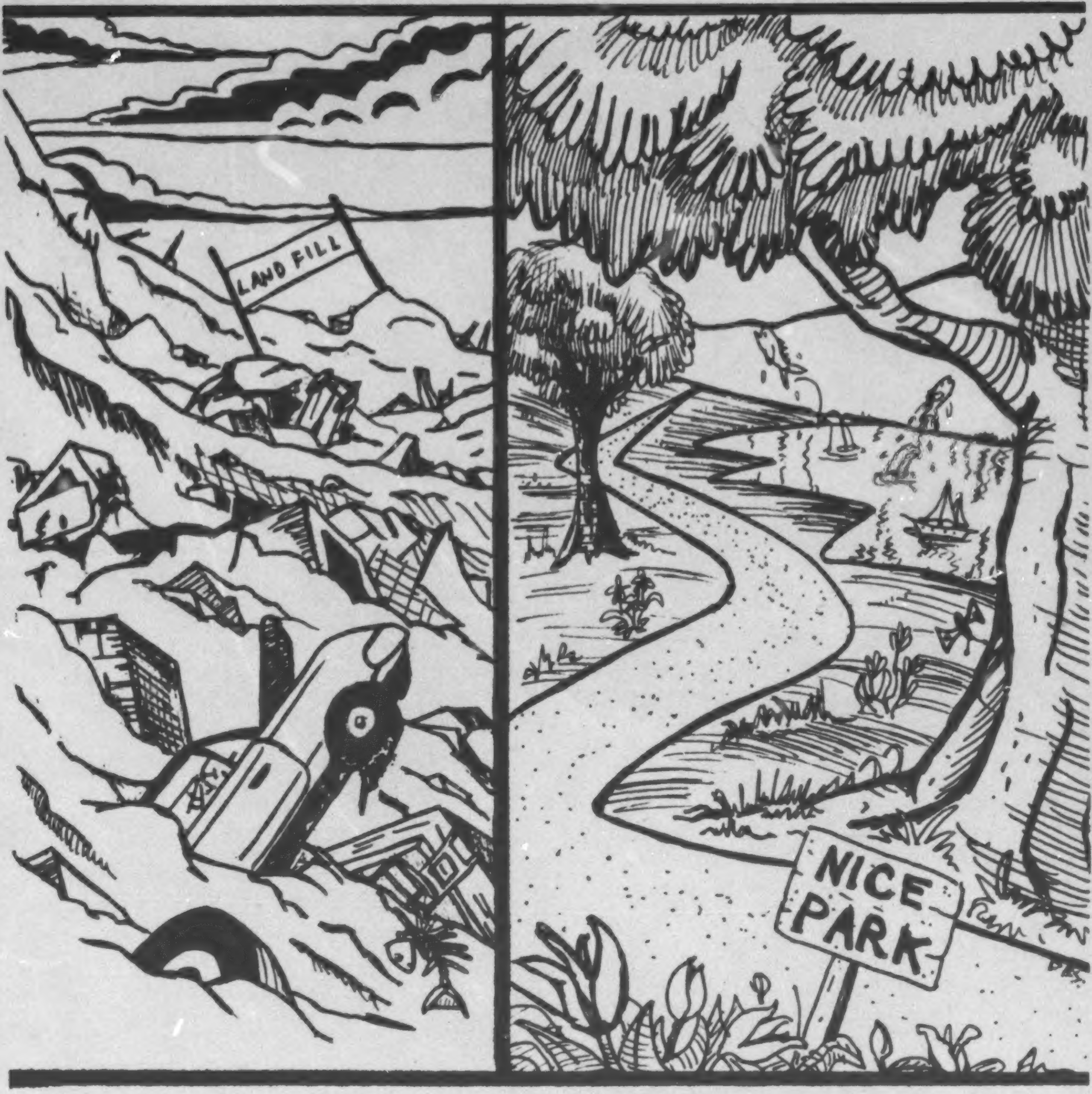
1) The materials found in the archeological dig consisted of broken pottery, animal bones and primitive utensils. The materials found in a modern day sanitary landfill would consist mainly of plastics and metals. One could expect to find old car tires, broken appliances, rusted car parts, bottles, plastic toys, and aluminum soda cans to name a few. The Industrial Revolution and modern technological advances have significantly altered the contents of our solid waste materials.

2) Wild game was plentiful. Lakes,streams, and rivers served as a source of food. The land the cave man chose to live on was capable of supporting his family.

3) Trade must have existed between people of other regions.

4) Both situations seem quite similar. However, the cave man discarded materials that would rapidly decompose and return to the soil. Modern day picnics often leave behind aluminum soda cans, plastic cups, and glass bottles which do not readily decompose.

5) Landfills today are extremely large. They are operated by sophisticated heavy machinery and accept a great variety and volume of waste materials. Sometimes wastes that are disposed of in sanitary landfills are considered hazardous.



IT IS THE PROVINCE OF CHILDHOOD TO DESTROY, IT IS THE DUTY OF MANHOOD TO PRESERVE AND RECLAIM.

V.P., THOMAS R. MARSHALL,1919

Landfills have been used for the disposal of solid waste throughout human history. Today's technological society not only produces more solid waste, but also produces solid waste of a different nature. Many of today's solid wastes are not biodegradable and are not suitable for landfill disposal. However, with proper management, most solid waste can be safely disposed of in sanitary landfills.

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING LESSONS:

B1 INTRODUCING : THE SANITARY LANDFILL

SKILLS: Reading comprehension, vocabulary, evaluation and criticism of writing, organizing information, working independently.

PREPARATION: None

Most of the solid wastes produced today are disposed of in sanitary landfills. There are limitations to the amounts and composition of solid wastes disposed of in sanitary landfills. In this lesson the students will learn about the structure and limitations of sanitary landfills.

B2 MIDNIGHT DUMPERS

SKILLS: Reading comprehension, vocabulary, creative writing, letter writing, sketching, working independently, values clarification.

PREPARATION: None

Many times wastes are dumped illegally in sewers, streams, landfills, swamps, quarries and open fields causing severe damage to the environment. In this lesson the students act as reporters and write fictitious articles along with cartoon pictorials about some aspects of illegal dumping.

B3 OUT OF SPACE

SKILLS: Reading comprehension, vocabulary, measurement, division, multiplication, addition, subtraction, problem solving, decimals.

PREPARATION: None

As land values and human populations increase and stricter environmental safeguards are enforced, space for solid waste disposal is becoming more difficult to find. In this lesson the students turn their backyard into a landfill and calculate how long it will take to fill it up with their family's solid wastes.

B4 WHAT GOOD IS AN OLD LANDFILL?

SKILLS: Reading comprehension, vocabulary, research techniques, library skills, recording observations, analysis and criticism of information, map-making, role playing, decision making, oral communication, group cooperation.

PREPARATION: See materials needed

A completed or filled landfill is often considered by many people to be useless land. However, with preparation and proper maintenance a completed landfill can serve a variety of purposes. This lesson will encourage the students to design and plan practical land uses for a completed landfill.

B5 EVERYBODY'S PROBLEM

SKILLS: Reading, vocabulary, interviewing, oral communication, recording observations, organizing information, research techniques, group cooperation.

PREPARATION: None

Economic, political, social and environmental issues all have an effect on the operation and lifespan of a sanitary landfill. In this lesson the students are asked to interview various members of the community and discuss how their differing views relate to these issues.

B6 DO YOU KNOW WHERE YOUR TRASH IS?

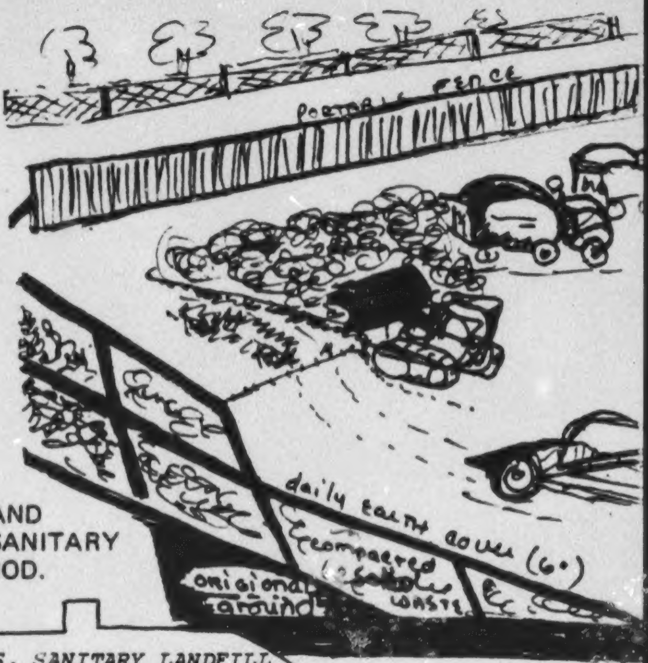
SKILLS: Reading comprehension, vocabulary, analysis and criticism of information, writing reports, organizing information, oral reporting, constructing visual aids, group cooperation, leadership abilities.

PREPARATION: Lesson 5

The majority of people do not know where their solid waste goes and are not concerned as long as they are not directly affected by its disposal. With the closing of many sanitary landfills, public involvement must increase to make the search for viable alternatives quicker and easier. In this lesson the students present a public meeting to inform and involve their community in the disposal of its solid wastes.

Some of the lessons in this unit require out of class time and others will require 2 or more class periods for completion.

B1 INTRODUCING – "THE SANITARY LANDFILL"



BIG IDEAS

The most common method of solid waste disposal is "sanitary landfilling".

The sanitary landfill, if designed, operated and maintained properly, can provide a safe means of waste disposal for people and the environment.

During the 1980's, a time of shortages, people are realizing that many dwindling natural resources are buried in sanitary landfills and permanently lost.

YOUR JOB IS: BECOME AWARE OF THE PROCESSES, ADVANTAGES AND DISADVANTAGES OF THE "SANITARY LANDFILL" DISPOSAL METHOD.

KEY WORDS

IMPERVIOUS, LEACHATE, METHANE GAS, SANITARY LANDFILL

MATERIALS

None

IMPERVIOUS - *A SUBSTANCE THROUGH WHICH LIQUIDS AND GASES WILL NOT PASS.*

LEACHATE - *RAIN WATER OR LIQUID THAT HAS PERCOLATED THROUGH SOLID WASTE AND HAS EXTRACTED SOME DISSOLVED MATERIALS FROM IT; SOME LEACHATE CONTAINS MATERIALS POISONOUS TO PEOPLE.*

METHANE GAS - *A HIGHLY FLAMMABLE AND EXPLOSIVE GAS, BOTH ODORLESS AND COLORLESS, PRODUCED BY DECOMPOSING GARBAGE OR OTHER ORGANIC MATERIAL.*

SANITARY LANDFILL - *READ ON*

BEGIN HERE: – A sanitary landfill is. . .

> *"... a method of disposing of refuse on land without creating nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical volume, and to cover it with a layer of earth at the conclusion of each day's operation or at such more frequent intervals as may be necessary."*

Confused? – Read on. . .

> *" ... a method of disposing of refuse on land without creating nuisances...*

Because the refuse is not burned and is sealed with soil or clay at the end of each day, there tends to be little difficulty with odors, insects, and rats. Portable fences are used to catch any blowing trash.

> *... or hazards to public health or safety...*

Fences should enclose the area of the landfill to keep out unauthorized people.

Leachate is a major problem with sanitary landfills. Lined channels or storm drains should be set up to trap and prevent storm waters from entering the rubbish. An impervious surface layer (such as clay) should cap the filled landfill to prevent rain water from entering the buried trash and producing leachate. Water testing wells should be drilled around the landfill site for water quality testing every three months.

Methane gas is another problem associated with many landfills. A program of "gas monitoring" should be set up at all sanitary landfills to test for the presence and movement of methane gas. Ventilation systems should be provided beneath and in all areas where methane gas has been detected. This prevents accumulation of explosive mixtures, odors, and possible fires.

OVER

...by utilizing the principles of engineering to confine the refuse to the smallest practical volume...

In general all sanitary landfills are a cell type (see diagram) with trash dumped, spread out, and compacted. The trash is compacted to the smallest volume by repeated passes with a bulldozer. Layers of solid waste before they are compacted are not more than three feet in depth. The addition of water will help to compact the layers. However, too much water will cause leachate to form and contaminate the ground water.

...and to cover it with a layer of earth at the conclusion of each day's operation...

Proper sanitary landfill operation requires that whenever the compacted trash reaches a maximum depth of twelve feet, the surface of the fill must be leveled, compacted, and covered with at least six inches of soil. All waste materials must be covered with soil by the end of the work day.

...or at such more frequent intervals as may be necessary."

Cover material should be applied immediately to all areas where sewage sludge or septic tank cleanout has been deposited. Soil cover in these areas should be a minimum of twelve (24) inches in depth.

CAN YOU DO THESE?

1) Open dumping often leads to foul odors, rats and insects. In what way does a sanitary landfill operator prevent these problems?
2) Strong winds are often responsible for blowing trash out of the landfill and into neighboring communities. What can a landfill operator do to keep the trash in the landfill?
3) Rainwater sometimes seeps through the solid waste in the landfill taking highly poisonous dissolved or suspended materials with it into the ground. "Leachate", as it is often called, poses a major problem. If it gets into the ground water supply where might it eventually end up? Would the people living in the surrounding communities be affected? If so, how?
4) Testing the underground water in the area of a sanitary landfill is extremely important. Why is it important and how often should the water be tested?
5) How is methane gas produced in a landfill and how is its presence detected?
6) Can you think of ways in which methane gas could be trapped and used productively?
7) What can be done to prevent the accumulation of methane gas?
8) Explain the process of the "cell type" sanitary landfill.
9) What is the final step of a sanitary landfill operation?

ON YOUR OWN:

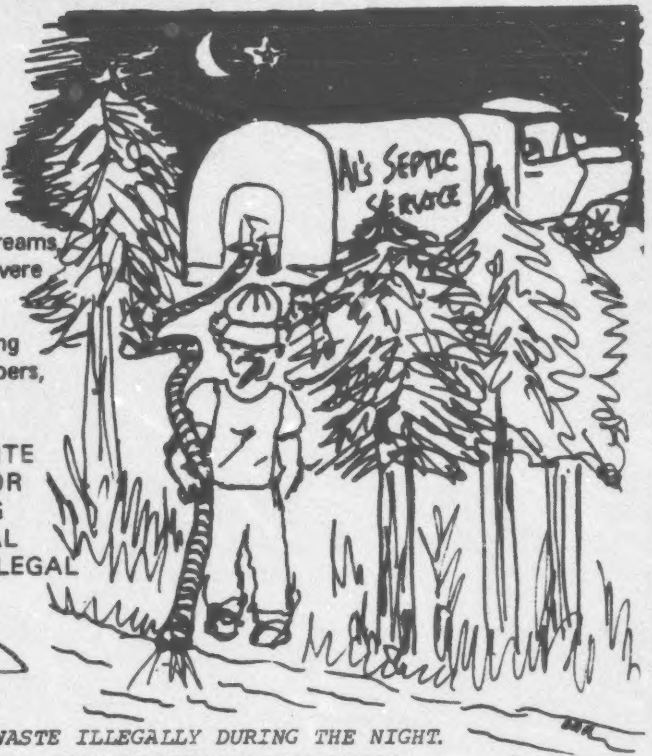
Make a random list of 25 materials you would expect to find if you were to dig through a sanitary landfill. Fill out the following chart.

Place each item on your list in the chart in the appropriate category.

RECYCLABLE	REUSEABLE	NO APPARENT USE
Aluminum beer cans	soda bottle	broken bicycle tire

If you are interested in recycling and reusing materials see unit 4, What if?

B2 MIDNIGHT DUMPERS



BIG IDEAS:

Many times wastes are dumped illegally in sewers, streams, landfills, swamps, quarries and open fields causing severe damage to the environment.

Strict laws and high disposal costs for the wastes along with the large sums of money paid to midnight dumpers, make illegal dumping an attractive option.

YOUR JOB IS: TO BE REPORTERS AND WRITE A FICTITIOUS NEWSPAPER OR MAGAZINE ARTICLE ALONG WITH A CARTOON PICTORIAL ABOUT SOME ASPECT OF ILLEGAL DUMPING.

KEY WORDS

MIDNIGHT DUMPERS, TIPPING FEE

MIDNIGHT DUMPERS - INDIVIDUALS WHO DUMP WASTE ILLEGALLY DURING THE NIGHT.
TIPPING FEE - MONEY PAID TO LANDFILL OWNERS FOR ACCEPTING SOLID WASTE.

BEGIN HERE:

James G. McCarthy dropped to his knees and sobbed into his hands as he pleaded for the health of his children. What had happened?

McCarthy lives one mile from a landfill dump site in Jackson Township, New Jersey. Recently (1978-1980) the people in his neighborhood have been suffering from severe health problems. His daughter died from a rare kidney disorder. He had to have a kidney removed and 10 of his neighbors have developed serious kidney ailments. In addition, many others have had respiratory problems, miscarriages, still-born infants, rashes and eye and ear infections. The cause — illegal chemcial dumping that polluted the water supply. After dark "Midnight Dumpers" drove trucks without headlights into the landfill and discharged chemical wastes.

Shocked!? According to government officials, illegal dumping of hazardous wastes occurs many times each day. Overburdened officials don't have time to check the thousands of tips and reports that they receive. The 700 or so dumps that have already been discovered are just the tip of the iceberg. Thousands of unknown dumps still remain to be found. Types of discarded wastes range in composition from simple litter and household garbage to complex chemicals, including herbicides, pesticides, and liquid wastes from industries. Why do people illegally dump waste?

There are several reasons why illegal dumping takes place. Essentially, it all boils down to money. People simply do not want to pay the high price for safe and secure disposal. (1) Fuel prices have skyrocketed and available disposal sites are often hundreds of miles away resulting in high transportation costs. (2) Tipping fees at landfills add to the disposal costs. (3) In the case of hazardous wastes, chemical neutralization or other methods of disposal can be expensive.

Under these circumstances many people take their household garbage and throw it along the sides of backroads or in fields. This environmental damage is largely aesthetic.

Some industries attempt to improve their profits by "unloading" their wastes cheaply and quietly after dark in the country or in landfills. Some landfill owners and operators are under investigation for possible links with organized crime. They may make large sums of money for allowing illegal dumping of hazardous wastes at their landfills: Private land owners can also make money by allowing illegal dumping on their property. Capturing "Midnight Dumpers" is next to impossible. "New Jersey uses 30 men, 10 on a shift, around the clock, in an attempt to catch illegal dumpers. They use expensive video equipment and special lenses." [1] However, they have had limited success. Even when illegal dumpers are caught, imposed fines are often cheaper than the original disposal costs.

---

[1] Burlington County Times, June 1980

OVER

What is the impact of dumping these wastes? Environmentally, it has been disastrous. The waste pollutes the soil and water, leaving it unfit for human consumption. It can cause serious illness and even kill as in Jackson Township, New Jersey. If illegal dumping continues at its current rate, it will affect millions of people.

Economically it costs millions of dollars to clean up just one illegal dump site. Who should pay? All of us? Or should the companies responsible pay? A "superfund" has been proposed by EPA. Industries must donate money to a fund that would be used for cleaning up illegal and hazardous waste sites. In addition, a "waste exchange program" has been organized. This aids industries in trading their waste products with other industries that can use the wastes.

The problem of illegal dumping is serious and affects all of us in some way. Your job is to be a reporter and write a fictitious newspaper or magazine article along with a cartoon pictorial about some aspect of illegal dumping. Use your creativity and the information you just read.

CAN YOU DO THESE?

1) What kinds of wastes are illegally dumped?
2) What are some reasons for illegal dumping?
3) What are some of the impacts of illegal dumping?
4) If you owned or worked in a company and could make money if you dumped waste illegally, would you? Why?

ON YOUR OWN:

The Sierra Club and Environmental Action have started a campaign to locate and clean up the country's hazardous waste sites. They have published a booklet called "Hunt the Dump". The booklet tells you how to identify companies that produce wastes; how to survey the kinds of waste they produce and how to find out where they dispose of them. It also includes a questionnaire that you can use to interview these companies. For your copy of "Hunt the Dump" (25 ¢) write to:

M. Wentworth
Environmental Action
1346 Connecticut Ave. N.W.
or call: 202 - 833 - 1845

B 3 OUT OF SPACE

Boy! That's a lot of solid waste!

BIG IDEAS:

In New Jersey alone the amount of municipal solid waste generated each day can fill the Giants Stadium every two weeks.

As land value and human population increase and stricter environmental safeguards are enforced, space for solid waste disposal is becoming more difficult to find.

The majority of solid waste disposed of daily comes from the home.

YOUR JOB IS: CALCULATE HOW LONG IT WILL TAKE TO FILL YOUR BACKYARD WITH YOUR FAMILY'S SOLID WASTES AND COMPARE THIS TO YOUR TOWN'S LANDFILL.

KEY
WORDS
ENVIRONMENTAL SAFEGUARDS, MUNICIPAL SOLID WASTE

__ENVIRONMENTAL SAFEGUARDS:__ LAWS OR PROCEDURES WHICH ARE ENFORCED TO PROTECT THE ENVIRONMENT.
__MUNICIPAL SOLID WASTE:__ SOLID WASTE WHICH COMES PRIMARILY FROM PEOPLE'S HOMES AND COMMUNITIES (i.e. - NOT AGRICULTURAL OR INDUSTRIAL SOLID WASTE).

BEGIN HERE

1) Measure your yard in feet or meters (length and width).
2) Measure the diameter of your curbside trashcan in both feet or meters.
3) Determine how many trash cans your family produces each week.
4) Let's assume your backyard is 30 feet long and 45 feet wide.
5) How many trashcans fit along the length of your yard? ex: 30 ft. (yard length) ÷ 2.5 ft. (can diameter) = 12 cans.
6) How many trashcans fit along the width? ex: 45 ft. (yard width) ÷ 2.5 ft. (can diameter) = 18 cans.
7) Multiply 18 cans X 12 cans to get total number of cans. (=216)
8) If it takes 216 cans to fill your yard and you put out 4 cans every week, then divide 216 by 4 = 54 weeks. If there are 52 weeks in a year, it will take two weeks more than a year to fill up your yard.

YOUR DATA

YARD LENGTH (centimeters & inches)	CANS	YARD WIDTH (centimeters & inches)	CANS	TRASHCAN DIAMETER	NUMBER OF TRASHCANS NEEDED TO FILL YARD

CANS PRODUCED PER WEEK	TIME NEEDED TO FILL YARD
	________ WEEKS ________ MONTHS ________ YEARS

OVER

NEXT:

1) Find out your town's population (hint--call up your town hall)

2) Based on an average of 1 trashcan per person per week, calculate how long it will take to fill up your backyard if it was used as the town landfill.

3) How big is your town landfill? Is it almost filled up? Remember that the solid waste in the landfill is compacted and is not contained in trashcans.

4) How long do you think your town landfill has before it is filled? Where will your solid wastes go after it is filled?

ON YOUR OWN:

1) Try to think of ways to reduce the amount of solid waste you produce.

2) Think of some alternatives to landfill disposal.

DO IT METRIC ! !

4) Let's assume that your yard measures 10 meters in length and 15 meters in width and that your trash can is 0.75 meters wide.

5) How many trash cans fit along the length? ex: 10 m (yard length) ÷ 0.75 m (can width) = 13.3 cans.

6) How many trash cans fit along the width? ex: 15 m (yard width) ÷ 0.75 m (can width) = 20 cans.

7) Multiply 20 X 13.3 to get the total number of cans. (266 cans)

B4 WHAT GOOD IS AN OLD LANDFILL?

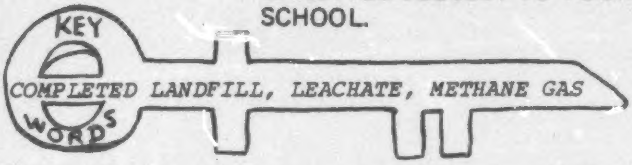
ACME BUILDERS PRESENTS
TRASH MOUNTAIN ESTATES
A PLANNED COMMUNITY
NOW OPEN

BIG IDEAS:

Old or "completed landfills" are often considered useless and unsightly parcels of land.

With the proper knowledge and preparation, a planning committee can design an environmentally compatible "Land-Use Plan" for a completed landfill.

YOUR JOB IS: DESIGN A "LAND USE PLAN" FOR THE SANITARY LANDFILL CLOSEST TO YOUR SCHOOL.



COMPLETED LANDFILL, LEACHATE, METHANE GAS

COMPLETED LANDFILL - A SANITARY LANDFILL SITE WHICH HAS REACHED ITS DUMPING CAPACITY AND IS NO LONGER USED FOR WASTE DISPOSAL.
LEACHATE - RAIN WATER OR LIQUID THAT HAS PERCOLATED THROUGH SOLID WASTES AND HAS EXTRACTED SOME DISSOLVED MATERIALS FROM IT; SOME LEACHATE CONTAINS MATERIALS POISONOUS TO PEOPLE.
METHANE GAS - A HIGHLY FLAMMABLE AND EXPLOSIVE GAS, BOTH ODORLESS AND COLORLESS, PRODUCED BY DECOMPOSING GARBAGE OR OTHER ORGANIC MATERIAL.

BEGIN HERE:

Read the following excerpts on the uses of completed sanitary landfills. From these you can see what several communities have planned for their completed landfills.

> *Landfills pose problems... leaching chemicals sometimes pollute ground water. Rotting garbage can generate methane gas. Dumping sites for a city's trash are getting more difficult to find.*
>
> *DuPage County, Illinois, just west of Chicago, is trying out a creative solution. Its people are turning a mountain of refuse into a recreational asset. Each days collection of garbage and trash is spread, tamped firmly and covered by a six inch layer of gravel and clay, which controls decompostion and unpleasant odors. So, layer by layer, the hill grows... it will be capped with more clay and soil and rising some 120 feet will stand as the highest elevation in the county. Six toboggan runs five ski slopes will weave down its sides... Locally its called "Mt. Trashmore."*[1] *(This particular landfill was filled with 1 part soil to 1 part refuse.)*
>
> *Another Mount Trashmore, between Virginia Beach and Norfolk, Virginia is a grass-covered "trash sandwich" some 800 feet long, 100 feet wide and 80 feet high that contains 640,000 tons of garbage... It will have a 10,000 seat amphitheater, parking lots, roads, and a tract for the Soap Box Derby. Meanwhile, the "son of Trashmore" is going up nearby.* 2

As you can see, these completed landfills are far from being classified as useless fragments of land. The people of the surrounding communities used their imaginations and designed a creative plan which turned a wasteland into a recreation site.

[1] Gordon Young, "Pollution, Threat to Man's Only Home," National Geographic, 138, No. 6 (1970),766

[2] Richard J. Ordway, Earth Science and the Environment (New York: Van Nostrand, 1974), p. 24

OVER

THINGS YOU SHOULD KNOW

To make a decision on environmentally sound land uses for a completed landfill site, you must consider the following factors: (You may need to research these factors in greater depth)

METHANE GAS	Significant production of methane gas in a landfill may not begin for several years after the refuse is deposited, and may continue for several decades (this depends on the construction of the landfill, the type environment and the components of the fill.) Methane gas has a tendency to migrate or move upward into the foundations of buildings constructed on landfills. This creates danger from explosion and fire. Ventilation systems for methane gas must be placed in the landfill. Landfill gases may also have harmful effects upon vegetation.
UNEVEN SETTLEMENT	As the garbage in the landfill decomposes if often leaves empty spaces. These empty spaces have a tendency to collapse or settle. This creates a poor foundation for building structures. Small, light frame structures may be constructed if they have extra support such as pilings which extend beneath the landfill into solid ground.
GROUNDWATER QUALITY	The groundwater under an old landfill is usually unfit for human consumption. This is due to the leachate which can enter the underground water supply. For this reason it is usually recommended that treated municipal water be piped into buildings utilizing old landfill sites.
HAZARDOUS WASTES	Many landfills have been used for the disposal of hazardous wastes. In addition to ground water contamination, these substances can sometimes find their way into the foundations of houses and structures on or nearby the completed landfill site. Residential housing is extremely dangerous under these conditions. (see lesson 4 in the "Hazardous Waste" unit.)

NEXT:

Now you are ready to design your own "Land Use Plan." Read and carry out the following instructions under your teacher's supervision. You will also need to notify the owner or operator of the landfill you will be visiting.

1) Divide the class into groups of six.
2) Each group should make arrangements for at least one of their members to visit the landfill closest to your school. Make a rough sketch or map of the area.
3) Assign each person in the group a position, (3) researchers, (2) planners, and (1) graphic artist.

The group as a whole will make up a list of all possible "Land Uses." Example land use plans could include the following; athletic facilities, parks and playgrounds. Think of others.

RESEARCHERS	Research the possibility of constructing each "Land Use" chosen by the group. Recommend 2 or 3 of your ideas to the planners.
PLANNERS	Design the actual "Lay-out" of the site after receiving the necessary information from the researchers. The planners will decide whether or not to construct buildings, plant trees and grass, pave roads, construct parking lots, etc.
GRAPHIC ARTIST	Illustrate the site from the preliminary to the final draft. The graphic artist is responsible for designing the map's "Legend" and can use colored pens for "color keying" purposes.

The final "Land Use Plan" can be presented by each group to the class. The class will discuss and critique the plans, and decide which one is the best overall "Land-Use Plan" for the completed sanitary landfill.

B5 EVERYBODY'S PROBLEM

BIG IDEAS:

Sanitary landfills account for the disposal of most of our country's solid waste. Complex social, economic, political and environmental problems often arise during the life of these landfills.

Many of the above problems were unknown in the past, but due to an increase in our population and in the amount of solid wastes we produce these problems are now too obvious to go unnoticed.

Jakestow
Opera
OFFICE

YOUR JOB IS: INTERVIEW VARIOUS MEMBERS OF YOUR COMMUNITY TO LEARN ABOUT YOUR LANDFILL.

KEY WORDS

METHANE GAS, SANITARY LANDFILL, SLUDGE, TOXIC

METHANE GAS - A HIGHLY EXPLOSIVE GAS, BOTH ODORLESS AND COLORLESS, WHICH IS PRODUCED BY DECOMPOSING GARBAGE OR OTHER ORGANIC MATERIAL.

SANITARY LANDFILL - A SITE OF SOLID WASTE DISPOSAL WHICH USES THE TECHNIQUE OF SPREADING, COMPACTING AND COVERING THE WASTE DAILY WITH A LAYER OF SOIL.

SLUDGE - A MUDDY RESIDUE LEFT FROM TREATED SEWAGE.

TOXIC - POSIONOUS TO ALL LIVING ORGANISIMS.

BEGIN HERE:

1) Make a list of as many problems you can think of that might arise over your community's landfill. Be sure to include the social, economic, political, and environmental aspects.

2) Look over the questionnaire and add other questions you think are pertinent.

3) Divide the class into 4 groups: A, B, C, D.
   - Group A - Interview landfill manager (or operator)
   - Group B - Interview a township official (Mayor, Health Officer)
   - Group C - Interview at least two (2) residents.
   - Group D - Interview at least one (1) business representative.

4) Groups C and D may have to leave out a few questions and add others to make their interview complete.

OVER

QUESTIONNAIRE

1) Is it a sanitary landfill or an open dump?
2) If a sanitary landfill; how often is it covered? What is used to cover it?
3) How many people operate this landfill? Part-time or full time?
4) When was the landfill opened?
5) For what reasons was the site chosen?
6) What tests, if any, were done at the site before the landfill opened? What were the results?
7) What was the landfill's original life expectancy? Was it an accurate projection? How much time does the landfill have left?
8) What types of solid wastes are dumped? Municipal? Chemical? Sludge or sewage? Toxic? Other hazardous materials?
9) Does the landfill regulate or control the materials dumped?
10) Is there a recycling program at the landfill? If so, what is recycled?
11) How much solid waste (tons) is disposed of each day?
12) What is the yearly cost to run the landfill?
13) Who uses the landfill aside from your community?
14) Have there been any complaints about the siting of the landfill? Odor complaints? Rat complaints?
15) What regular tests are performed at the landfill, if any? (i.e.: water tests, soil tests, methane tests.) What results were found?
16) Has anyone moved away due to contamination from the landfill?
17) Will the landfill be closed soon? If yes, why?
18) What alternatives will your town use if the landfill is closed?
19) Does your town have plans for the area once the landfill is closed? What are they?

NEXT:

When you have completed your interviews; prepare your results and present them to the rest of the class. Discuss the following questions:

1) Do you find discrepancies in the answers of each group?
2) How many points of view do you find?
3) What are some of the reasons for these varying opinions and answers, if any?
4) Which group seems to have the best understanding of the landfill operation? Why?
5) Which group knows least about the landfill operation? Why?
6) Did you interview anyone who did not know where their trash was taken? If yes, why do you think that happened?
7) You might have found that many people in your community are not aware of the complex problems involved in landfill operations. You can help to inform your friends, parents and community members by using your interview data to present a public awareness program. See the next lesson for details.

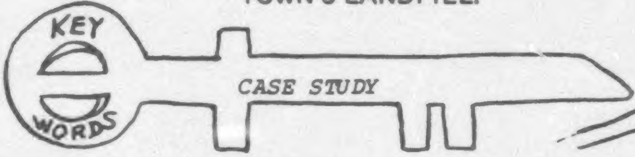
B6 DO YOU KNOW WHERE YOUR TRASH IS?

BIG IDEAS:

The subject of solid waste disposal ends on the curb for the majority of Americans. Most people are unaware of the many problems that just begin with the curbside pickup of their solid wastes.

Interested and concerned citizens can help to enlighten members of their community on this subject.

YOUR JOB IS: PREPARE A COMMUNITY PRESENTATION ABOUT YOUR TOWN'S LANDFILL.



CASE STUDY - *A WRITTEN STUDY OF A SPECIFIC PLACE, SITUATION, PERSON OR SUBJECT.*

BEGIN HERE:

Divide up into your groups from the previous lesson.

1) Read the example case study of a typical landfill.
2) Identify the social, political, economic and social issues that appear in the case study.
3) Organize your data from the previous lesson.
4) Begin writing your case study. You can use the enclosed example as a model or you can make up your own format.
5) Each group should expand and emphasize the point of view of the people they interviewed.
6) Prepare your presentation to include as many visual aids as possible. These can be photographs of the landfill, posters describing recycling programs in existence, and graphs which illustrate the amounts and types of solid wastes entering the landfill. You could even invite a guest speaker who is knowledgable in this subject.
7) Ask your teacher to help you plan your presentation.
   Things to consider:
   - a) place (hint: school auditorium, town hall).
   - b) time (at least 2-3 weeks from now)
   - c) publicity: you must inform the community well in advance of the meeting. Posters, flyers, newspapers, and radio can help you with this.
   - d) organization: Which groups should speak first? Who will be spokesperson for your group? etc. . .
   - e) practice giving your presentations in class first.

OVER

CASE STUDY: JONESBERRY SANITARY LANDFILL

HISTORY:

The Jonesberry Sanitary Landfill located on Maple Drive in New Mills, New Jersey, opened in 1960 with a projected life expectancy of 20 years. The landfill site was chosen by state environmental specialists on the basis of soil type, water table depth, and potential hazards to local housing developments. The latter was minimal since the landfill is far from residential areas and is bordered by blueberry and cranberry fields. Covering 26.8 acres the landfill handled 58 tons of domestic wastes per day when it closed in 1980.

OPERATION

The landfill was operated under the supervision of one foreman and one equipment operator. It was covered with a ten inch layer of soil each day. Every week the previous week's deposit was smashed and compacted by heavy machinery. The township was the exclusive user of the landfill. Five private trash haulers from the township dumped at the landfill on successive days. They were not charged a tipping fee for this service. Private dumpers, including families and businesses also dumped at the landfill without charge.

Sewage trucks ("honey dippers") were allowed to discharge at the landfill for a minimal fee. Their trucks were not inspected or checked for the presence of materials other than sewage. A few residents suspected the presence of hazardous liquid wastes in these trucks.

PROBLEMS WITH THE LANDFILL

The Jonesberry Landfill closed in 1980 because its expected lifetime was up and it was filled to capacity. Other factors, however, would have contributed to its closing. Periodic testing of local wells by EPA (Environmental Protection Agency) officials uncovered the presence of high levels of contaminants. These included iron, lead, phenol compounds and other organic chemicals. There was no question that these contaminants originated from the landfill. The wells were condemed and 2 families were forced to move away.

Meanwhile the Jonesberry Sanitary Landfill is being covered with a thick layer of soil and clay as a final cover.

Plans have been submitted to reclaim the land as a country club with an 18 hole golf course.

AFTER CARRYING OUT THE TASKS IN THIS LANDFILL UNIT THE STUDENTS WILL BE ABLE TO:

	Activities Which Meet These Objectives
1. Describe the operation of a sanitary landfill.	1
2. List at least 3 problems associated with sanitary landfills and their possible solutions.	1
3. Identify 2 or more types of illegally dumped wastes.	2
4. Identify 2 reasons why illegal dumping occurs.	2
5. Identify at least 2 impacts or effects of illegal dumping.	2
6. Develop an awareness of the amount of solid waste produced by the student's own family.	3
7. List at least 3 possible land uses for a completed sanitary landfill.	4
8. Describe at least 3 limitations in the use of completed sanitary landfills.	4
9. Discuss how the operation of a sanitary landfill can involve problems of social, economic, environmental and political importance.	5
10. Participate in the presentation of a public awareness program on the community landfill.	6

GLOSSARY

COMPLETED LANDFILL - A SANITARY LANDFILL WHICH HAS REACHED ITS DUMPING CAPACITY AND IS NO LONGER USED FOR WASTE DISPOSAL.

ENVIRONMENTAL SAFEGUARDS - LAWS OR PROCEDURES WHICH ARE ENFORCED TO PROTECT THE ENVIRONMENT.

IMPERVIOUS - A SUBSTANCE THROUGH WHICH LIQUIDS AND GASES CANNOT PASS.

LEACHATE - RAIN WATER OR LIQUID THAT HAS PERCOLATED THROUGH SOLID WASTE AND HAS EXTRACTED SOME DISSOLVED MATERIALS FROM IT; SOME LEACHATE CONTAINS MATERIALS POISONOUS TO PEOPLE.

METHANE GAS - A HIGHLY FLAMMABLE AND EXPLOSIVE GAS, BOTH ODORLESS AND COLORLESS, WHICH IS PRODUCED BY DECOMPOSING GARBAGE OR OTHER ORGANIC MATERIAL.

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SLUDGE - A MUDDY RESIDUE LEFT FROM TREATED SEWAGE.

TIPPING FEE - MONEY PAID TO LANDFILL OWNERS FOR ACCEPTING SOLID WASTE.

TEACHER GUIDE

B1 INTRODUCING: THE SANITARY LANDFILL

(Can you do these?)

1) The sanitary landfill operator should cover the refuse at the end of the day with soil or clay to help minimize these problems.

2) Portable fences should be set up near work areas to catch blowing trash.

3) Leachate may eventually end up in drinking water. It could contaminate the water and make it unfit for human consumption.

4) Every three months water tests should be performed. These tests will show if the landfill is contributing to ground water contamination.

5) Methane gas is produced when garbage or other organic material decomposes. A gas monitoring program should be set up to test for the presence and movement of methane gas.

6) Most answers are acceptable. The idea of piping the methane gas out of the landfill and into containers where it could be burned at will is the most favorable.

7) Ventilation systems allow the methane gas to escape in small, harmless amounts into the air.

8) The trash is dumped, spread out, and compacted into individual cells.

9) All waste materials must be covered with soil by midnight of the day when the waste is dumped.

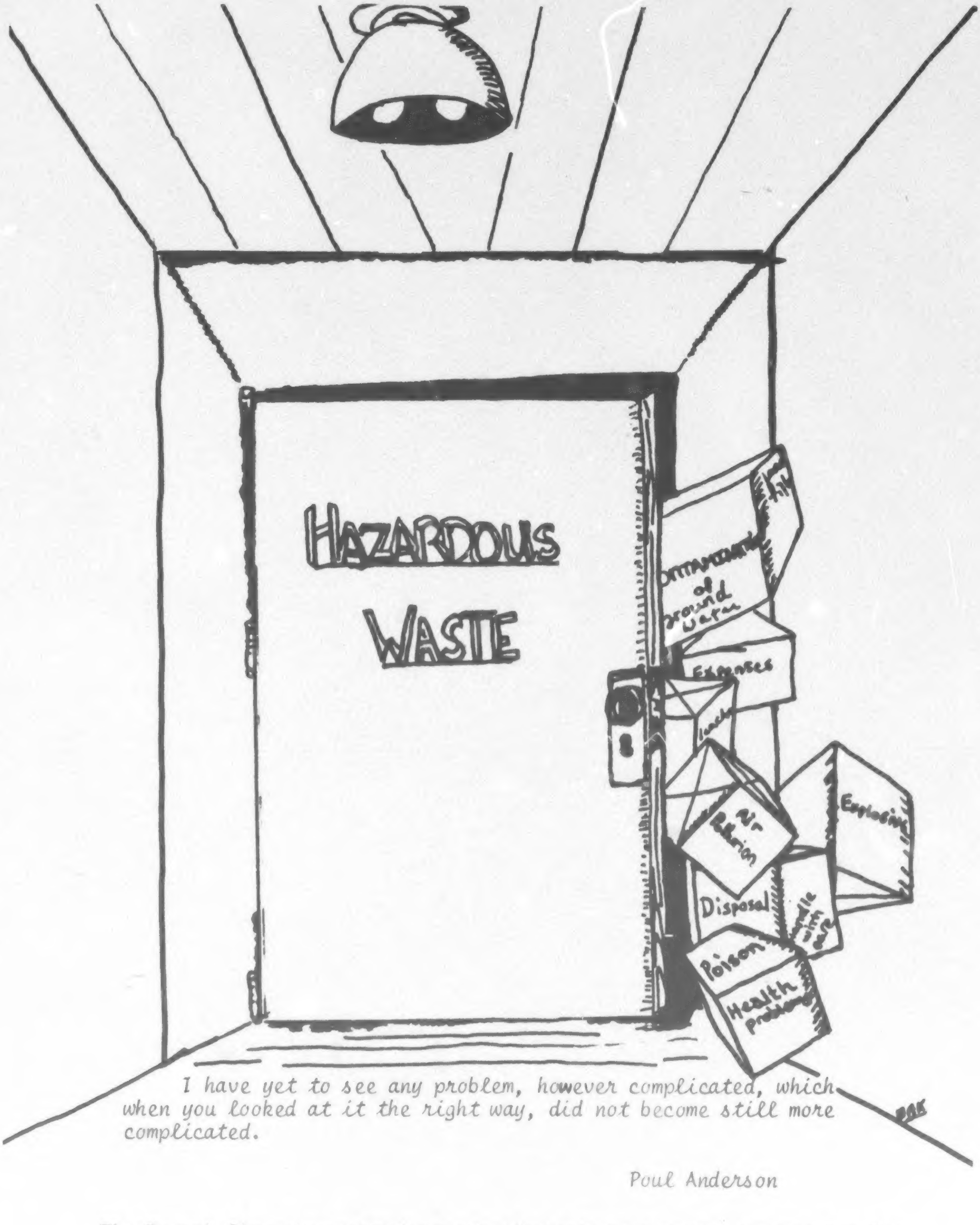
B2 MIDNIGHT DUMPERS

(Can you do these?)

1. Illegally dumped wastes include simple litter (paper, bottles and cans, and household garbage), and complex chemicals (pesticides, herbicides and industrial wastes).

2. High transportation costs, high tipping fees, expensive alternative disposal methods (eg. chemical neutralization).

3. (1) Soil, air and water pollution (2) Animal and human sicknesses and death (3) High costs for cleanup.


HAZARDOUS
WASTE
ONTAMINATION
of
ground
water
Expenses
leach
Air
Pollution
Explosive
Disposal
Handle
with
care
Poison
Health
problems
PAK

I have yet to see any problem, however complicated, which when you looked at it the right way, did not become still more complicated.

Poul Anderson

The disposal of hazardous wastes is a problem that concerns everyone. Improper handling and disposal of hazardous wastes can contaminate ground water, pollute the air, burn or explode, poison plant and animal life, and produce long range health problems in humans. In many cases it is not profitable to dispose of hazardous wastes in a proper manner. For certain hazardous wastes safe methods of disposal are still unknown. However, if people are to maintain environmental quality favorable to their existence, sound disposal methods for hazardous wastes must be implemented.

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING LESSONS:

C1 HAZARDOUS WASTE IS . . .

SKILLS: Reading comprehension, vocabulary, letter writing library skills, research techniques, writing reports, oral reporting, poster making, graphs

PREPARATION: None

Hazardous wastes, the discarded solids, liquids, sludges or gases that come from many sources pose a clear danger to environmental quality and human health. In this lesson the students investigate and research a category of hazardous waste and prepare an oral report for the class.

C2 HOME HAZARDOUS WASTES

SKILLS: Reading comprehension, vocabulary, recording information, interpretating data, working independently.

PREPARATION: None

Everyone contributes to the hazardous waste problem. People are indirectly responsible for hazardous wastes when they buy and use products which create wastes in their manufacture. People also contribute by discarding hazardous materials with their household trash. In this lesson the students discover what hazardous materials they can find in their own homes by conducting a scavenger hunt. A class discussion following the hunt may help to draw out the problems of hazardous waste disposal in the home.

C3 DISPOSAL DILEMMA

SKILLS: Reading comprehension, vocabulary, creative writing, organizing information, research techniques, library skills, letter writing, group cooperation.

PREPARATION: Lesson C2

Few present disposal methods dealing with hazardous wastes appear to provide safe and permanent removal of these wastes from the environment. In this lesson the students research one disposal method and write a case study describing the impacts of the method on the environment and on the people living there.

C4 HAZARDOUS WASTES: HARMFUL OR HEALTHY?

SKILLS: Reading comprehension, vocabulary, research techniques, library skills, sketching, oral reporting.

PREPARATION: None

Hazardous wastes have many different effects on living organisms. Certain hazardous wastes in small quantities may have little immediate effect but long range effects can be magnified by nature's food chain. In this lesson the students will trace the path of a hazardous substance from small concentrations at the bottom of the food chain to large concentrations at the top of the food chain.

C5 LOVE CANAL

SKILLS: Reading comprehension, vocabulary, research techniques, library skills, organizing information, analysis and evaluation of information, oral communication, role playing, group cooperation, leadership abilities, decision making.

PREPARATION: None

The improper handling and disposal of hazardous wastes has resulted in permanent damage to life and the environment. In this lesson the students will study and discuss the Love Canal Disaster. They will review the viewpoints of the people involved in this disaster and represent them in a classroom court session.

C6 WHAT CAN YOU DO?

SKILLS: Reading comprehension, vocabulary, creative writing, letter writing, organizing information, research techniques, oral reports, public speaking, graphs, group cooperation, leadership ability, organization skills.

PREPARATION: None

Environmental awareness and protection begins at the community level. It is the responsiblity of concerned and knowledgeable citizens to inform their peers about ways to maintain favorable environmental quality. In this lesson the students plan, organize, and present a hazardous waste conference to draw the community's attention to this crisis.

Note: Some of the lessons in this unit require out of class time and others will require two or more class periods for completion.

C1 HAZARDOUS WASTE IS . . .

KEEP OUT!!!
HAZARDOUS CHEMICALS
PESTICIDES

BIG IDEAS:

Hazardous wastes are discarded solids, liquids, sludges and gases that pose a clear danger to environmental quality and human health. They come from industries, hospitals, research facilities and government operations. Industries generate most of these wastes to produce energy and materials that we all require or expect in our daily lives.

YOUR JOB IS: INVESTIGATE AND RESEARCH A SOURCE OF HAZARDOUS WASTE AND PRESENT A 15 TO 30 MINUTE TALK TO YOUR CLASS.

KEY
WORDS
ENVIRONMENTAL QUALITY, HAZARDOUS WASTES

ENVIRONMENTAL QUALITY - THE STATE OF THE ENVIRONMENT WHICH INCLUDES AIR, WATER, LAND AND ALL OF THE FACTORS LIFE DEPENDS UPON FOR IT'S EXISTENCE.

HAZARDOUS WASTES - WASTES WHICH ARE CONSIDERED DANGEROUS TO LIVING ORGANISMS OR TO THE ENVIRONMENT.

BEGIN HERE:

MATERIALS: None

Billions of tons of solid wastes are discarded in the United States every year. They originate from a wide variety of sources and vary significantly in their composition. They range from simple household garbage to complex residues from industrial, agricultural, mining or military operations. The U.S. Environmental Protection Agnecy estimates that 57 million tons of these wastes can be labeled as hazardous in 1980. What is hazardous waste?

A hazardous waste is "a solid waste that may cause or significantly contribute to serious illness or death,or that may pose a substantial threat to human health or the environment when improperly managed." (Everybody's Problem: Hazardous Wastes, U.S. EPA 1980 page 12). In other words, hazardous wastes can poison, burn, maim, blind and kill living organisms. They can affect the human nervous system and internal organs and cause skin disorders, cancer and birth defects.

Sometimes their effects can be felt immediately after exposure. Other times they may not show up for weeks, months or years. Many do not breakdown. They can remain hazardous for hundreds of years. Others are susceptible to biological magnification. (Note: see lesson 3. Hazardous Wastes: Harmful or Healthy)

NEXT:

Hazardous wastes come in many forms. They exist as solids, liquids, sludges, slurries and gases. They come from the production and use of numerous materials that we need or expect for our daily existence. These materials include plastics, pesticides, medicines, paints, oils and gasoline products, nuclear materials, metals, soaps, explosives, detergents, fertilizers, cosmetics, etc...The list goes on and on.

Sixty percent of hazardous wastes (excluding nuclear) in the U.S. come from the chemical industry. Other sources include hospitals, research facilities, military operations and the metal industry. Homes, schools, and businesses are additional sources of hazardous waste.

Unfortunately, many hazardous wastes in the past have been disposed of without environmentally sound safeguards. This improper handling and disposal, compounded by illegal dumping, has resulted in a serious environmental crisis.

OVER

NEXT:

Divide into groups of four. Each group should pick a source of hazardous waste listed on the back. Investigate and research your source and prepare a 15 to 30 minute oral presentation for the class. Stress how your category affects man and the environment. You may use visual aids such as posters, models, graphs, and charts to illustrate your talk. Sources of information include magazines, newspapers, textbooks, and pamphlets. Use your school and county libraries. Ask your teacher and librarian for help.

Write to the following address for additional information:

Environmental Protection Agency
Solid Waste Program
26 Federal Plaza
New York, N.Y. 10007

SOURCES OF HAZARDOUS WASTE

- Medicines
- Nuclear Power
- Pesticides
- Fertilizers
- Paints
- Metals
- Plastics
- Textiles
- Explosives

CAN YOU DO THESE?

In your own words write definitions for the following terms:

a. solid waste

b. hazardous waste

c. toxic

d. environment

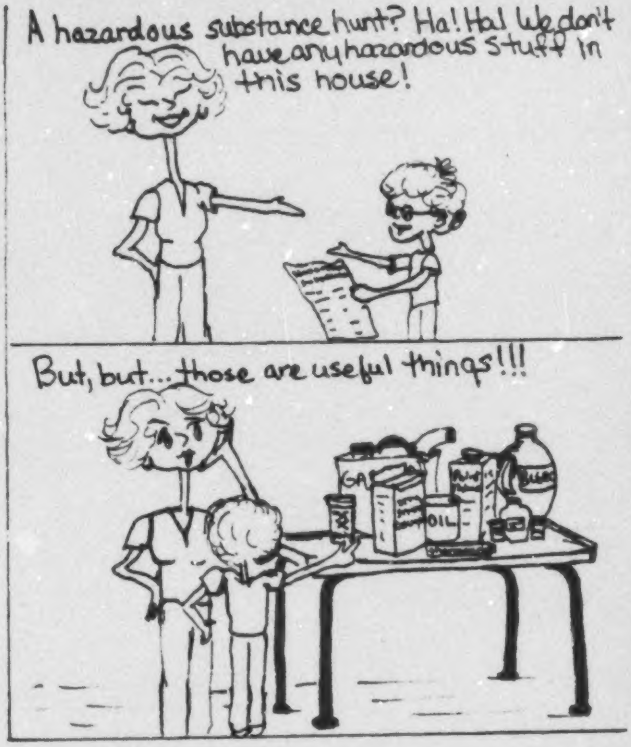
e. ecosystem

C2 HOME HAZARDOUS WASTES

BIG IDEAS:

Everyone contributes to the hazardous waste problem. People are indirectly responsible for the production of hazardous wastes by buying and using the products which create the waste. People may also contribute by discarding hazardous materials from their own homes. Examples of these materials are paint thinners, oil from the family car, insecticides or other animal poisons and strong detergents.

YOUR JOB IS: HAVE A SCAVENGER HUNT TO FIND HAZARDOUS MATERIALS IN YOUR HOUSE.


A hazardous substance hunt? Ha! Ha! We don't have any hazardous stuff in this house!
But, but... those are useful things!!!
GAS
OIL
BLEACH

BEGIN HERE:

Many hazardous substances can be found in the home. They usually serve a useful purpose or function. The examples below will help you to begin your home search.

Hazardous Substances Commonly Found In The Home

- cleaning fluids
- paint solvents
- medicines
- weed killers
- insecticides & pesticides
- oil & gasoline
- battery acid
- bleach
- prescription drugs
- fluorescent lights
- mercury from thermometers
- asbestos insulation

These materials are called hazardous because they can harm people and/or the environment. Their characteristics are:

1. ignitability (burn or explode easily)
2. corrosivity (corrode or rust through materials)
3. toxic (can produce sickness or death in living organisms)
4. reactive (combine with other material)
5. infectious (can cause diseases in living organisms)
6. radioactive (can damage living tissue by active radio-isotope decay)

When you go home tonight, search for all of the hazardous substances you can find. For each one, record the following information on the chart provided.

1. Name of material
2. Use of material; i. e. cleaning, gardening, repair, etc.
3. Hazardous characteristic; i. e. toxic, reactive, etc.
4. Disposal; i. e. discarded with household trash, transported to dump etc.
5. Environmental effects of disposal, if known; i. e. water or air pollution, biomagnification in food chain (see lesson C4), soil contamination, etc.

OVER

Home Hazardous Waste Chart

Products	Use	Hazardous Characteristics	How is it Disposed of?	Environmental Effects

NEXT:

Compare your chart with those of other students.

Which hazardous materials are most commonly found in the homes surveyed?

How are they disposed of?

Does their present disposal method harm the environment? If yes, how?

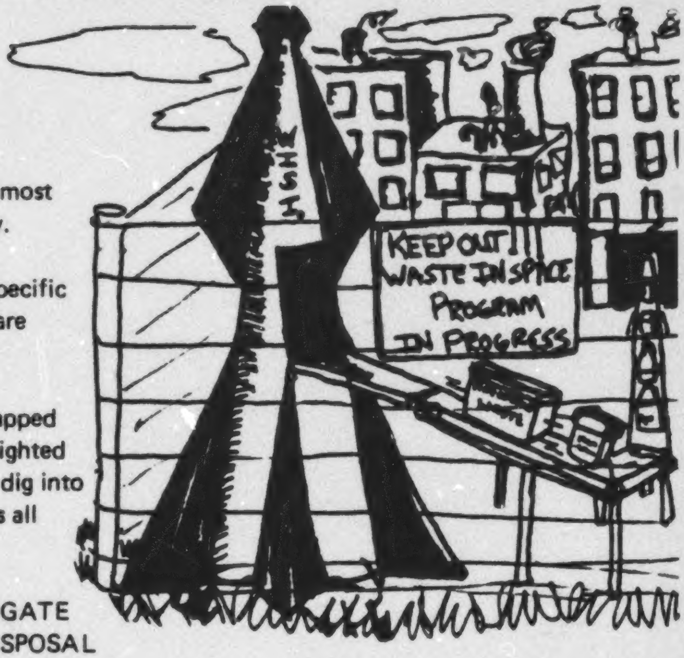
What are some alternatives to common disposal methods for hazardous wastes?

To find out more about the disposal of hazardous wastes see the next lesson, C3.

ON YOUR OWN:

LOOK UP: Time September 22, 1980 "Poisoning of America"

C3 DISPOSAL DILEMMA



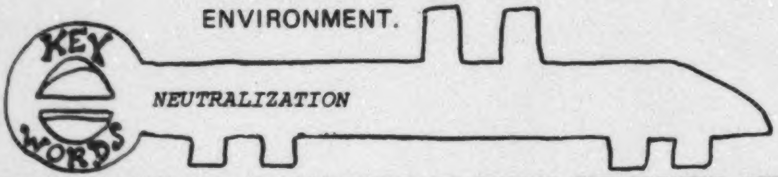
BIG IDEAS:

The disposal of hazardous wastes is one of the most difficult problems that confronts society today.

Each type of hazardous waste may require a specific method of disposal. Not all disposal methods are suitable for every hazardous waste.

The disposal of hazardous wastes in securely capped and sealed landfills is a temporary and short - sighted solution; future generations may unknowingly dig into forgotten landfills and inherit today's problems all over again.

YOUR JOB IS: RESEARCH AND INVESTIGATE A HAZARDOUS WASTE DISPOSAL METHOD AND WRITE AN IMAGINARY CASE STUDY INCLUDING IMPACTS ON PEOPLE AND ON THE ENVIRONMENT.



NEUTRALIZATION - TO ELIMINATE OR REDUCE THE HARMFUL EFFECTS OF A SUBSTANCE BY ADDING CHEMICALS.

BEGIN HERE:

Divide yourselves into groups of 3. Each group is responsible for the following:

1. Choose a different disposal method from the list below.
2. Find out everything you can about it. (use the sources in the back)
3. Is your method used today?
4. What hazardous wastes can be disposed of by this method?
5. What hazardous wastes are not suited to this method?
6. What are the pros and cons of your method?
7. What are the ethical issues, if any, of your method?

Choose a disposal method from the following list:

Physical Treatment: The purpose of this process is to reduce the volume of hazardous wastes by solidifying them or separating the solid particles from the liquid they were in. Two examples include evaporation to remove liquid and filtration to remove the solids.

Chemical Treatment: This is used primarily with hazardous wastes which cannot be recycled The wastes are detoxified or neutralized by adding various chemicals. One example is the addition of lime to battery acid. The lime lowers the pH of the battery acid to a neutral level.

OVER

Biological Treatment: These methods of treatment use microorganisms to break down the hazardous wastes into simpler compounds. Land application of sewage sludge is the most well known example. The wastes are mixed with soil and microorganisms. Few wastes are suitable for this method.

Thermal Treatment: This method destroys the hazardous wastes by burning it at high temperatures. A chemical compound found in plastics called PCB are often incinerated. The incineration must be carried out a extremely high temperatures or the PCB's may escape into the atmosphere.

Recycling: Many hazardous wastes contain valuable resources. The reuse of these wastes is becoming more practical due to the scarcity of raw materials. Examples of wastes which can be recycled are used motor oil and compounds of mercury, lead, chlorine and bromine. However, it is first necessary to concentrate the wastes into a pure form by expensive treatment processess.

Landfill Disposal: Hazardous wastes can be capped and sealed in secure landfills before or after treatment. This is the least expensive method of disposal. Problems include possible leakage, loss of valuable land and loss of natural resources which could have been recycled.

Exportation: The exportation of hazardous wastes for disposal in other countries. Poor countries may agree to accept hazardous wastes because of their lack of knowledge and the money they receive.

Underground well injection: The injection of liquid hazardous wastes deep into underground rock layers is a new and experimental method.

Ocean dumping: The disposal of hazardous wastes at sea.

Space Disposal: The loading up of hazardous wastes onto rockets for disposal in outer space.

Storage: The storage of hazardous wastes until the time that a practical and economical method of disposal is discovered.

Illegal Disposal: The dumping of hazardous wastes indiscriminately; causing damage to the environment and creating health hazards to the public without a permit from an environmental agency.

Impacts to discuss in your story can be taken from the following list:

1. Impacts on water and aquatic life.
2. Impacts on plant life.
3. Impacts on animal life.
4. Impacts on the air.
5. Emotional impacts on people.
6. Physical impacts on people.
7. Impacts on society in general.

ON YOUR OWN:

1. What hazardous wastes can you find in your own home?
2. Where and how are they disposed of?

RESOURCE INFORMATION
ON HAZARDOUS WASTE

Readers Guide to Periodical Literature (Many popular magazines and journals presently contain articles on hazardous wastes. Ask your Teacher for additional references).

League of Women Voters - Primer on Hazardous Wastes 1730 Main Street N.W. Washington, D.C. 20036

EPA Region 2, Solid Waste Section
26 Federal Plaza, New York, New York 10007.
Two Free pamphlets;
a) Hazardous Wastes; Everybody's Problem No. SW-826 1980
b) Hazardous Wastes Facts No. SW-737

N.J. DEP, Solid Waste Section, Trenton, N.J. 08625

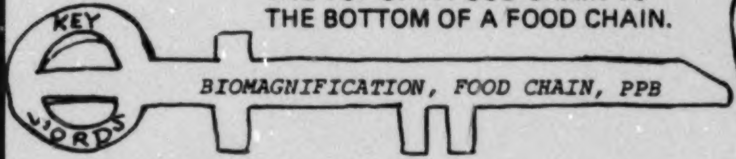
C4 HAZARDOUS WASTES: HARMFUL OR HEALTHY?

BIG IDEAS:

Some hazardous wastes burn and explode. Others pollute water and air supplies. Most of them can either damage or kill living organisms.

In small amounts they may have little effect. However, nature's food chain can collect some of these wastes and leave large concentrations of them in living organisms. This is known as biomagnification.

YOUR JOB IS: TRACE THE PATH OF A HAZARDOUS MATERIAL FROM THE TOP OF A FOOD CHAIN TO THE BOTTOM OF A FOOD CHAIN.

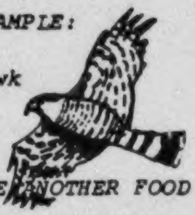


BIOMAGNIFICATION, FOOD CHAIN, PPB

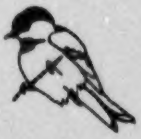
- *BIOMAGNIFICATION* - *ALL PLANTS AND ANIMALS HAVE THE ABILITY TO CONCENTRATE SOME SUBSTANCES CONTAINED IN THEIR FOOD OR DRINKING WATER. SOME SUBSTANCES ARE INCREASINGLY CONCENTRATED AS THEY PASS UPWARD IN A FOOD CHAIN. THE CONCENTRATION PROCESS IS KNOWN AS BIOMAGNIFICATION.*
- *FOOD CHAIN* - *PLANT FEEDING ANIMALS (HERBIVORES) ARE EATEN BY OTHER ANIMALS (CARNIVORES). SOME ANIMAL FEEDERS ARE THEMSELVES EATEN. THE SERIES OF ANIMALS WHICH FEEDS UPON ONE ANOTHER IS CALLED A FOOD CHAIN.*

EXAMPLE:

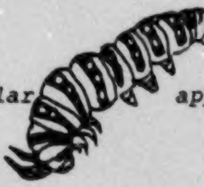
hawk



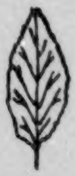
chickadee



caterpillar



apple leaf



SEE ANOTHER FOOD CHAIN ON THE BACK OF THIS PAGE.

- *PPB* - *(AN ABBREVIATION FOR PARTS PER BILLION).*

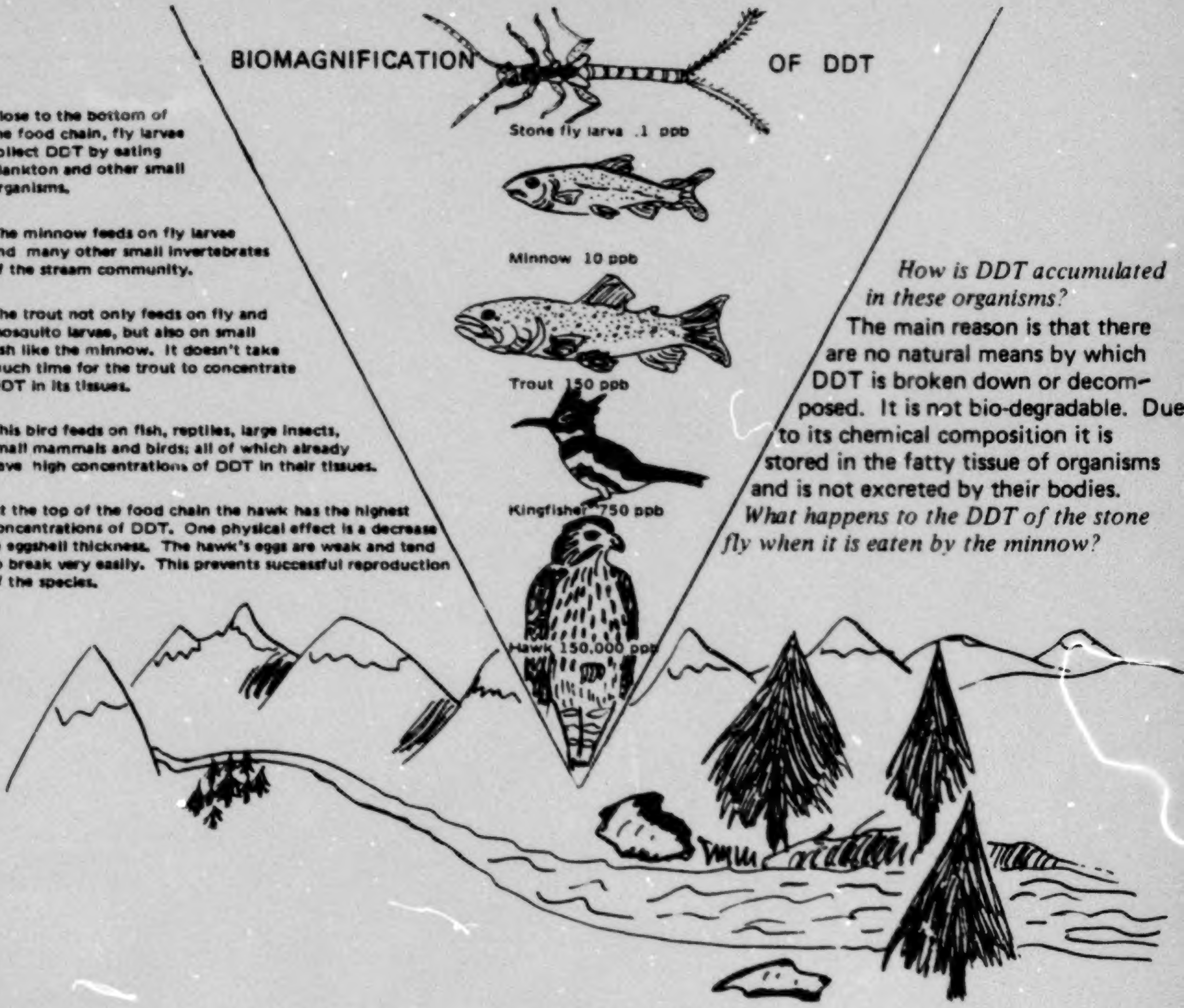
BEGIN HERE:

Read the following example of the biomagnification of DDT. The insecticide DDT is now banned in the United States. It and many other similiar chemicals often become hazardous wastes. (This example is hypothetical).

> *Imagine you have a very serious insect problem in your cornfield and you decide to use DDT to control it. You spray your fields once at about 9 a.m. Immediately you test the water of a small stream nearby for signs of DDT. You find .01 parts per billion, a very small concentration. Thirty minutes later you test again and find .00 parts per billion. What happened to the DDT? Did it wash downstream? Did it dissolve or decompose in the water?*
>
> *You find your answer when you test the bodies of various organisms found in the stream community.*

OVER

BIOMAGNIFICATION OF DDT



Close to the bottom of the food chain, fly larvae collect DDT by eating plankton and other small organisms.

The minnow feeds on fly larvae and many other small invertebrates of the stream community.

The trout not only feeds on fly and mosquito larvae, but also on small fish like the minnow. It doesn't take much time for the trout to concentrate DDT in its tissues.

This bird feeds on fish, reptiles, large insects, small mammals and birds; all of which already have high concentrations of DDT in their tissues.

At the top of the food chain the hawk has the highest concentrations of DDT. One physical effect is a decrease in eggshell thickness. The hawk's eggs are weak and tend to break very easily. This prevents successful reproduction of the species.

How is DDT accumulated in these organisms? The main reason is that there are no natural means by which DDT is broken down or decomposed. It is not bio-degradable. Due to its chemical composition it is stored in the fatty tissue of organisms and is not excreted by their bodies. *What happens to the DDT of the stone fly when it is eaten by the minnow?*

NEXT:

Trace the concentration of another introduced environmental pollutant such as lead from gasoline along a food chain. Below are lists of hazardous substances and different environments. Select one substance and one environment and try to locate information about them.

GROUP A

Hazardous Substance

- PCB
- mercury (from motor oil or other materials)
- lead (from gasoline etc.)
- cadmium
- other pesticides similiar to DDT

GROUP B

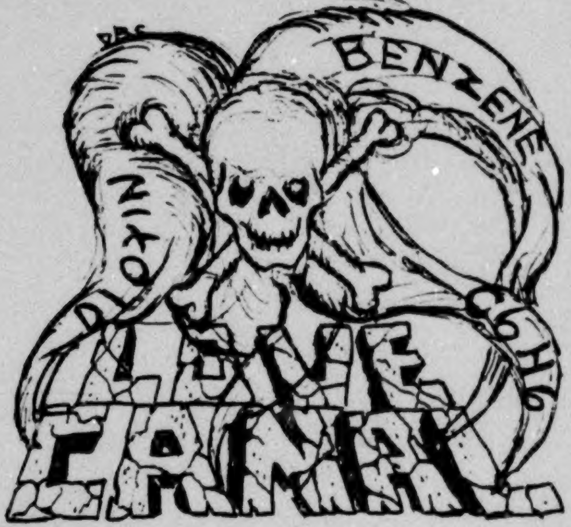
Environments

- Forest
- Pond
- Ocean
- Marsh
- Desert

Draw a food chain or pyramid similiar to the example above. Try to identify the relationships between the organisms in your environment. You can find this information in your biology text and in your library's ecology books. Information on hazardous substances can be found in the Readers Guide to Periodical Literature and in encyclopedias. Ask your librarian for help.

When you have completed your drawing you can present it to the class.

C5 LETHAL LITTER - WHO PAYS ?



BIG IDEAS:

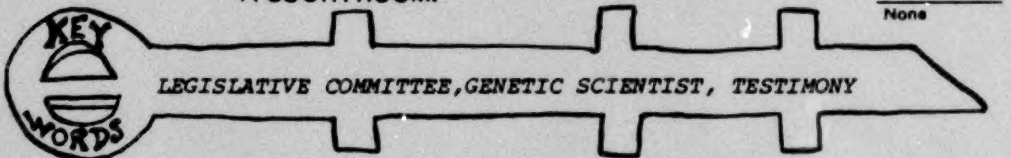
Improper handling and disposal of hazardous wastes has resulted in permanent damage to life and the environment.

Dangerous chemical waste dumps have been found at more than twenty sites in the United States (see diagram). They are considered to be only the tip of the iceberg.

Although federal and state governments have offered to evacuate families from hazardous waste locations, the responsibility and solutions are still unknown.

YOUR JOB IS: READ THE FOLLOWING ARTICLE ON THE LOVE CANAL DISASTER. TURN YOUR CLASSROOM INTO A COURTROOM.

MATERIALS
None



LEGISLATIVE COMMITTEE, GENETIC SCIENTIST, TESTIMONY

__LEGISLATIVE COMMITTEE__ - A BODY OF ELECTED OFFICIALS WITHIN THE LEGISLATIVE BRANCH OF THE GOVERNMENT WHO MAKE OR ACT UPON SOME MATTER OF THE LAW.
__GENETIC SCIENTIST__ - ONE WHO STUDIES THE INHERITED CHARACTERISTICS OF PLANTS OR ANIMALS.
__TESTIMONY__ - AN ORAL STATEMENT MADE BY SOMEONE UNDER OATH IN A COURT OF LAW, A SPECIAL EXAMINING BODY OR DECISION MAKING BODY. PERSONS WHO TESTIFY ARE REQUIRED TO HAVE COMPETENT EXPERIENCE OR TRAINING.

BEGIN HERE:

Read the enclosed article and descriptions on Love Canal.

Divide the class into six (6) teams. Each team will represent one of the following groups.

1) Residents of Love Canal (including two lawyers to represent them).
2) Legislative committee to hear testimony.
3) Hooker Chemical officers and lawyers.
4) United States Environmental Protection Agency (EPA) officials.
5) State and other federal agency representatives.
6) Scientific panel reviewing research.

Research the viewpoints of the interest group that your team is representing. You should try to put yourself in their shoes. Collect information that would further describe the facts, viewpoints, and reactions of the people from your group.

A good place to find older news clippings is in the "clipping file" maintained by your area newspaper (it must be daily). The clipping file at the newspaper is known as the "Morgue" and is used by reporters to provide background information for new articles. The "New York Times" serves as a good reference.

OVER

Use the "Readers Guide to Periodical Literature" found in your school or local library as a means of retrieving information from previous issues of magazines and journals.

PREPARE YOUR AMMUNITION!

Ask the "legislative committee" team what rules you will use to present your materials. Select and organize the speakers who will present the viewpoints and feelings of the people your team represents.

GO TO IT!

Conduct the hearings as planned, and decide at the trial:

1) What group or groups or individuals are at fault?
2) What should be done now?
3) Who should pay the price for clean-up and compensation?
4) How should the victims be compensated? Can they be compensated?

ON YOUR OWN

Find other hazardous waste sites in the United States. Follow the same procedure as you did for "Love Canal".

1) If you lived near Love Canal what would you do?
2) If you worked for Hooker Chemical what would you do?
3) If you worked for E.P.A. what would you do?
4) If you were the President or the Governor of the State of New York, what would you do?
5) If you were a concerned citizen anywhere, what would you do?

C5

LOVE CANAL - A BEAUTIFUL NAME FOR ONE OF THE MOST POLLUTED PLACES ON EARTH

Late in the nineteenth century a business man named John Love wanted to build a large industrial city near Niagara Falls, New York. A canal was needed to enable shipping to bypass the falls. Work on the canal started in 1893. The plan for the city and canal fell apart, but not without leaving a halfmile trench which was to have been the canal.

For the past 40 years, this 16 acre area southeast of Niagara Falls, New York, called "Love Canal", has been a dumping ground for dangerous chemical wastes. It is likely that no one thought these chemical wastes were harmful. The Hooker Chemical Company of the Occidental Petroleum Corporation is known to have initiated this practice of dumping. The Federal Defense Department denied accusations that it too was involved. During this time the residential district of "Love Canal" was growing larger. Its residents knew nothing about the health hazards associated with living close to a chemical dump.

When the community decided that it needed a new school, the Hooker Chemical Company sold them a portion of the dumping area for one dollar. The Hooker Chemical Company is accused of preparing the site for construction by "capping" the dumped chemicals with a thin layer of top soil. Subsequently the school was built on top of the dump in the early 1950's.

In the years following, new houses were built closer to the dumping site. Rain filled the dump causing chemicals to move through the soil and into the basements of Love Canal homes. Some of the chemicals oozed out of the soil to the surface. The stage for tragedy was now set.

The residents of Love Canal began to show signs of poor health, such as cancer, miscarriages, deformed babies and respiratory ailments. People suspected resurfacing chemicals as the cause. They asked for government relief. Love Canal made national headlines. Everyone blamed someone else. The Hooker Chemical Company, the Defense Department, the state of New York and the Niagara Falls School Board denied responsibility.

The residents of Love Canal were infuriated over the inaction. They formed the Love Canal Homeowners Association and hired lawyers. They brought suit against Hooker Chemical Company. The case dragged on; more suits and counter suits were filed. The Environmental Protection Agency wanted 124 million from the Hooker Chemical Company, the state of New York wanted 600 million and the Love Canal residents wanted 10 billion dollars.

By this time the residents of Love Canal were frightened and angry. They wanted their community declared a disaster area by the federal government so that they could receive compensation for their property and moving expenses.

More government inaction led to the abduction of two Environmental Protection Agency officials by Love Canal residents for several hours. They also burned an effigy of President Carter.

The Federal Government took action. The present proposals include:

A "superfund" to clean up all "Love Canals" in the United States.

Money to house the people in nearby motels until Love Canal is cleaned up.

TIP OF THE ICEBERG

ROCKY MT. ARSENAL

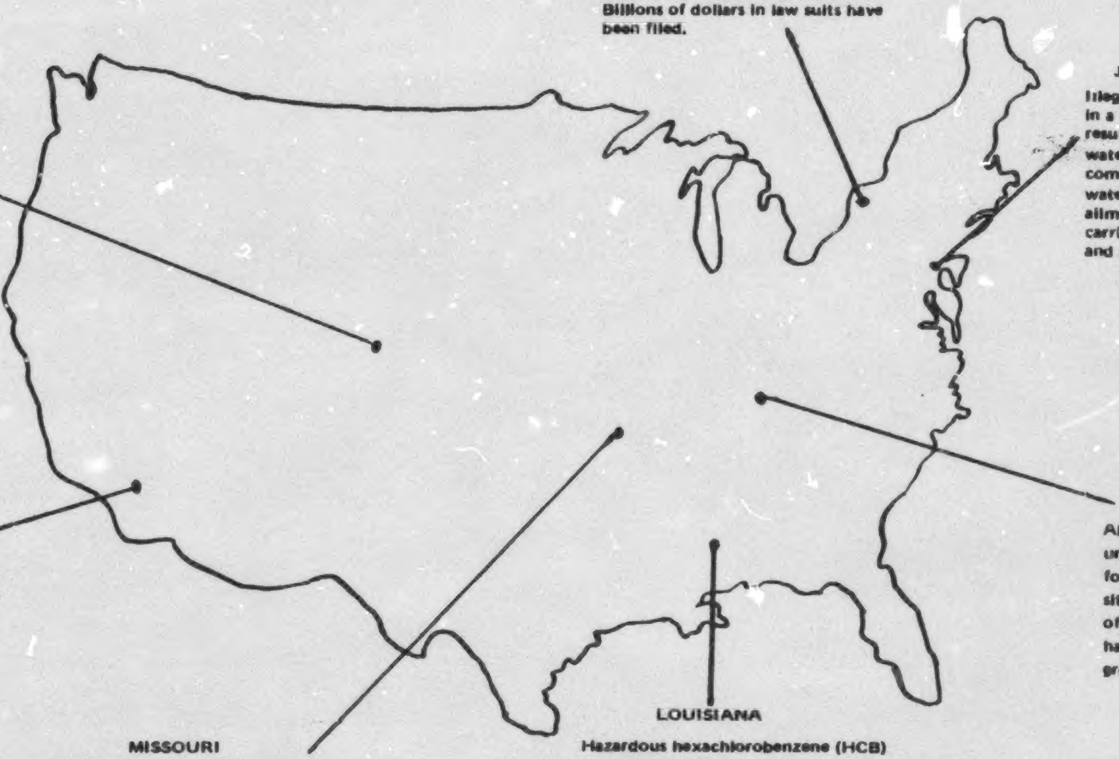
Disposal of toxic chemical wastes (including chemical warfare agents, herbicides and pesticides) in unlined ponds by the U.S. Army Chemical Corps and Shell Chemical Company took place here between 1943 and 1957. The environmental damage includes soil and water pollution that is still evident, crop damage, and bird kills.

LOVE CANAL, N.Y.

For many years Hooker Chemical Company dumped hazardous wastes in a 16 acre site near Niagara Falls. The dump site was closed in the 1950's. Houses and a school were built on and near the site. Drinking water became contaminated and toxic chemicals resurfaced. Residents have had miscarriages, deformed babies, cancer, and respiratory ailments. Billions of dollars in law suits have been filed.

JACKSON TOWNSHIP, N.J.

Illegal dumping of hazardous wastes in a state-licensed town-owned landfill resulted in contamination of the area's water supply. Many of the residents coming in contact with the polluted water have developed serious kidney ailments, respiratory problems, miscarriages, still-born infants, rashes, and eye and ear infections.



RIVERSIDE COUNTY, CA

Over 32 million gallons of waste acids and caustics were dumped into Stringfellow landfill by area industries. Some of these hazardous materials leached into the groudwater and Santa Anna River. It is costing the State over 13 million to close the site.

KENTUCKY

About 17,000 drums containing unknown toxic chemicals were found scattered about a 7 acre site near Louisville. Six thousand of the drums were leaking their hazardous contents into the groundwater and nearby streams.

MISSOURI

Toxic Dioxin poisoning caused by improper waste disposal resulted in various illnesses to people including kidney inflammation, bladder bleeding, diarrhea, nausea, headaches, polyarthralgias and persistent skin lesions. In addition, dogs, cats, birds, and insects died.

LOUISIANA

Hazardous hexachlorobenzene (HCB) contaminated the air, soil, and water over a 100 square mile area. Exceptionally high levels were found in cattle grazing the area, a result of bioaccumulation. HCB in humans can cause liver deterioration, acute skin sensitivity and blistering, uncontrolled hair growth, tremors, convulsions, and even death.

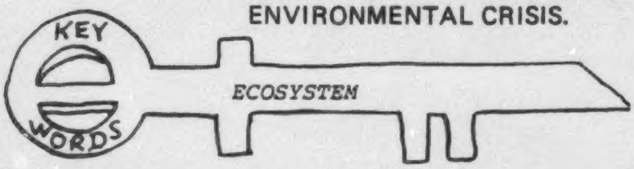
C6 WHAT CAN YOU DO?

1st ANN
HAZARDOUS
Ms. DOT

BIG IDEAS:

Environmental awareness and protection begins at the community level. It is the responsibility of concerned and knowledgable citizens to inform their peers about ways to protect the environment from hazardous wastes.

YOUR JOB IS: PLAN, ORGANIZE, AND PRESENT A HAZARDOUS WASTE CONFERENCE AT YOUR SCHOOL TO DRAW THE COMMUNITY'S ATTENTION TO THIS ENVIRONMENTAL CRISIS.



__ECOSYSTEM__ - INCLUDES ALL OF THE PLANT AND ANIMAL COMMUNITIES IN AN AREA ALONG WITH THEIR NON-LIVING SURROUNDINGS.

BEGIN HERE:

MATERIALS: none

The purpose of the previous activities on hazardous waste was to give you a chance to develop an increased awareness and understanding of this dangerous national problem. You have seen that it is not only an economic and technical problem, but also one of maintaining favorable environmental quality for survival. Many essential ecosystems have been severely impaired or totally destroyed because of the unknowing and sometimes irresponsible actions of people.

In the not too distant future you will be the decision makers responsible for protecting and preserving environmental quality, perhaps as a solid waste specialist, a community leader or as a concerned citizen. However, there is no need to wait for direct action. You can take a number of different steps to help develop positive environmental attitudes and values in your community. What can you do?

NEXT:

Environmental awareness and protection begins at the community level. Obtain permission to give your presentation to another class. Effective presentations require careful planning and organization. Divide your class into several groups. Select group leaders and one overall team leader. Have each group select and complete one of the topics listed below. Be sure to include most of the information and knowledge you have previously gathered regarding hazardous wastes. Chart 1 provides a list of hazardous waste subtopics that you may want to cover.

CHART 1. SUBTOPICS FOR HAZARDOUS WASTES

1. What are hazardous wastes?
2. The hazardous waste disposal dilemma.
3. Environmental hazards from hazardous waste.
4. Hazardous waste catastrophes.
5. What can individuals do about hazardous waste?
6. What can communities do about hazardous waste?

OVER

ECO-ACTION ACTIVITY LIST

1. Language Arts

Many times information and critical comments can be passed on by various types of poetry (e.g. Cinquain or Haiku) or aphorisms along with some sketches and drawings. Comic strips and cartoon stories are additional creative methods for passing on information. Your groups may want to try to publish a booklet containing their works on hazardous wastes.

2. Crafts/Art

The construction of collages, mobiles and posters provides an effective means of communicating information and ideas. As an added incentive have your artistic works judged by the people attending your conference to see which is their favorite.

3. Research Investigations

Your findings from research investigations may be reported or summarized by constructing diagrams, data sheets, graphs, models, slide shows or displays.

4. Speeches

Short informative speeches are an effective means of transferring knowledge and increasing awareness. In addition to having classmates talk, you may want to invite one or two guest speakers who are knowledgeable about hazardous waste.

5. Public Information Booth

An information booth at your conference providing free pamphlets and other materials is an excellent means of acquainting citizens with the hazardous waste crisis.

For free materials write to:

Office of Solid Waste Management Programs
Environmental Protection Agency
Washington, D.C. 20460

and/or

New Jersey DEP Solid Waste Administration
P.O. Box 1390
Trenton, New Jersey 08625

FOLLOW-UP AND PROMOTIONAL ACTIVITIES

6. Radio Time Spots

Many local radio stations have short time spots which they would be willing to fill with interesting local activities. Prepare and tape short informative statements about your class project. Be sure to include the time and place of your conference.

7. Newspaper Articles

Write short articles in reference to your hazardous waste investigations and conference. Have your teacher contact the newspaper to find out particulars such as the form to be used, best time for submittal and if a picture can be included.

8. Newspaper

Newsletters provide an excellent means of reporting class activities to the school and the community.

CAN YOU DO THESE?

1. Write to community, state and/or federal government officials to find out more about hazardous waste.

ON YOUR OWN

1. Read newspapers and magazines to find out more about hazardous waste problems in your community and the nation.
2. Try to develop your own alternatives to the hazardous waste disposal methods which are used today.

AFTER CARRYING OUT THE TASKS IN THIS HAZARDOUS WASTE UNIT

THE STUDENTS WILL BE ABLE TO:

	TASKS WHICH MEET THESE OBJECTIVES:
1) Write a definition of hazardous waste in their own words.	1
2) Research a topic and present an oral presentation of their results.	1
3) List at least two hazardous wastes often found in the home.	2
4) Describe how everyone contributes to the hazardous waste problem.	2
5) Identify the pros and cons of the available means of hazardous waste disposal.	3
6) Describe how hazardous wastes may affect living organisms.	4
7) List at least two types of hazardous wastes and their effects on the environment.	4
8) Describe and discuss the Love Canal incident.	5
9) Identify at least three separate viewpoints of people involved in Love Canal.	5
10) Identify two or more means of advertising and promoting a conference.	6
11) List at least three ways of presenting information.	6

GLOSSARY

BIOMAGNIFICATION - THE CONCENTRATION OF SUBSTANCES FROM ONE ORGANISM TO ANOTHER THROUGH THE FOOD CHAIN.

ECOSYSTEM - INCLUDES ALL OF THE PLANT AND ANIMAL COMMUNITIES IN AN AREA ALONG WITH THEIR NON-LIVING SURROUNDINGS.

GENETIC SCIENTIST - ONE WHO STUDIES THE INHERITED CHARACTERISTICS OF PLANTS OR ANIMALS.

HAZARDOUS WASTE - WASTES WHICH ARE CONSIDERED DANGEROUS TO LIVING ORGANISMS OR TO THE ENVIRONMENT.

NEUTRALIZATION - TO ELIMINATE OR REDUCE THE HARMFUL EFFECTS OF A SUBSTANCE BY ADDING CHEMICALS.

PPB - ABBREVIATION FOR PARTS PER BILLION.

CESC
CETA
7 - 9

IT'S A PAIN IN THE NECK.

WHO CARES?

WHO WANTS IT?

SO? TOO LITTLE

Leave me alone.

Who needs it?

TO LATE

TERRIFIC!

BUG OFF!

MAYBE.

IT BUGS ME.

WHAT'S THE USE?

HOO BOY.

HOORAY!

WHOOPEE.

TOO BAD!

TOO MUCH

MAKES SENSE AND CENTS!

REUSE THE REFUSE!

GREAT IDEA!

SO WHAT!

far out!

¿QUE?

BORING

I DON'T UNDERSTAND

BLOW IT OUT YOUR NOSE!

Big deal.

What's the big idea?

Swell.

POSSIBLY

ABSOLUTELY!

CAN'T WAIT!

WASTE OF MONEY

SAVES ENERGY

DUMB.

really neat.

I SEE.

DUMP IT.

TIDDY TOO.

wait and see

D.B.S.

WASTE OF TIME

DROP THE WHOLE THING.

CAN'T WASTE

LET'S DO IT!

NOW!!

LATER!

WILL IT WORK?

WHAT IF WE RECYCLED?

PROBABLY

SOONER OR LATER?

GOOD LUCK.

CAN'T STOP IT.

SOONER THAN YOU THINK.

DO WHAT YOU WANT.

KEEN.

BUMS ME OUT!

GOOD GRIEF.

MARVELOUS.

I DON'T CARE

yes.

? Count me out.

NO!

NOT INTERESTED.

TAKE A WALK.

!!

WOW!

WHEN?

I'm Impressed

WHY SHOULD'NT WE?

Gee Whiz.

FOR WHAT?

FORGET!

I THINK IT STINKS

NATURE DOES IT.

TOO EXPENSIVE.

CAN'T AFFORD NOT TO!

You're kidding?

Why not?

FOR THE FUTURE!

DO IT!

NO KIDDING!

WHY WAIT?

Let me thinke about it.

FOREVER

DON'T ASK ME.

OYVEY!!!

Why bother?

FOR PURPLE MOUNTAINS MAJESTIES.

ME? I'M FOR IT.

I DON'T EVEN KNOW HOW TO RIDE ONE.

Peachy.

WHATS IN IT FOR ME?

What?

STUPID.

ITS THE WAY OF THE FUTURE

¡MUY BUENO!

I'M NOT SURE!

HOLY COW!

GORE!

ITS BEYOND ME

ASK SOME ONE ELSE

WAY TO GO!

holy smoke.

PLAN FOR TOMORROW.

Its in my way

LET IT BE.

I'M WHOLLY FOR IT.

IT'S A COMMUNIST PLOT!

IT'S PLAIN TO ME.

PIP PIP!

HIP HIP HOORAY!

GET LOST!

We're Lost without it.

IT'S UP TO US.

WORKS IN A COMMUNE.

I'M HIP!

GOOD COMMUNITY PROJECT.

A REAL BUMMER.

SURE.

NOT ON MY BLOCK!

I DON'T KNOW.

NO GOOD!

WITHIN THIS UNIT ARE CONTAINED THE FOLLOWING LESSONS:

D-1 RETURN TO RETURNABLES OR RECYCLE GLASS?

PREPARATION: None

SKILLS: Reading comprehension, vocabulary, letter writing, research techniques, organization of information, library skills, oral communication decision making.

The increasing use of nonreturnable disposable bottles contributes to the amount of solid waste discarded each day. Many of these bottles end up thoughtlessly thrown along roadsides, adding to unsightly litter. Two solutions to these problems are (1) the use of returnable deposit bottles and/or (2) the recycling of glass. Both the recycling and reuse of glass bottles use less energy than making new bottles from sand. In this lesson the students will compare the pros and cons of each issue and decide which one they prefer.

D-2 SOURCE SEPARATE?

PREPARATION: None

SKILLS: Reading comprehension, vocabulary, addition, subtraction, problem solving, decimals.

Source separation, the separation of reusable and recyclable solid wastes before they are collected and mixed together can save time, resources and money. Materials that can be easily source separated include newspapers, glass, metal and used motor oil. In this lesson, the students source separate newspapers and/or other materials at home and at school. They also answer questions about a chart which depicts the various amounts of gasoline that can be saved by recycling solid wastes.

D-3 WHAT IF WE RECYCLE STEEL , ALUMINUM AND GLASS?

PREPARATION: None

SKILLS: Reading comprehension, vocabulary, graphs and tables, addition , subtraction, multiplication, division, problem solving, letter writing, oral reporting.

Recycling materials such as steel, aluminum and glass can provide money for local communities and conserve energy. Recycling reduces the amount of virgin natural resources that must be used. It also reduces the solid waste load going to the landfills, thereby increasing their life expectancies. In this lesson the students take the information provided about New Jersey's recyclable steel, aluminum and glass and display it in graphic form.

D-4 BURN GARBAGE FOR ENERGY?

PREPARATION: See materials

SKILLS: Reading comprehension, vocabulary, division, multiplication, problem solving, model construction letter writing.

Presently Americans create more waste than they can deal with effectively. The U.S. Environmental Protection Agency estimates that by 1995 each American will be producing 5.27 pounds of waste everyday. Possibly as much as 75% of our solid waste can be used as a supplement to coal, oil, and natural gas for use as an energy source. In this lesson, the students build a model steam turbine and use discarded newspapers as a power source.

Some of the lessons in this unit require out of class time and others will require 2 or more class periods for completion.

D1 RETURN TO RETURNABLES OR RECYCLE GLASS?

Ah, my dear—I will return!
But... they might not even recycle me Stanley!
Diet Cola
NO DEPOSIT NO
COLA
RETURN FOR

BIG IDEAS:

The rapidly increasing volume of disposable glass contributes to the loss of available space in sanitary landfills. These bottles also add to roadside litter and utilize valuable energy in their production.

Two solutions to the above problems are (1) use of returnable deposit bottles and/or (2) recycling of glass.

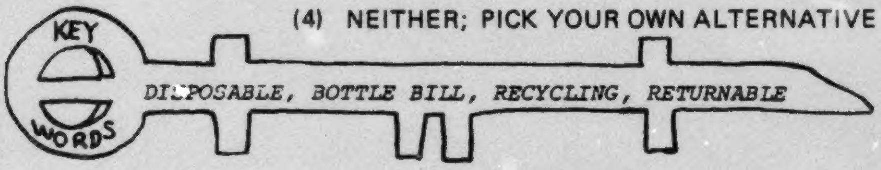
MORE ABOUT THE BIG IDEAS:

People like disposable bottles because they are convenient. They can be thrown out and forgotten easily. However, it is not so easy to ignore the large amounts of bottles seen along roadsides. Landfills are filling up quickly and have no room for more disposable bottles. Energy supplies are decreasing while energy needs increase.

Recycling glass from used bottles uses less energy than making new bottles from sand. Returning bottles for sterilization and reuse also uses less energy than making brand new bottles. The use of returnable bottles for carbonated beverages alone could save 81,000 barrels of oil and 5.2 million tons of glass, not to mention a decrease in roadside litter. Who wants to throw dimes and quarters out of their car's window? Both the use of returnable bottles and the recycling of glass can provide solutions to existing problems.

YOUR JOB IS: DECIDE WHICH SOLUTION YOU PREFER:

(1) RETURNABLE, DEPOSIT BOTTLES
(2) RECYCLING GLASS
(3) BOTH
(4) NEITHER; PICK YOUR OWN ALTERNATIVE


KEY WORDS
DISPOSABLE, BOTTLE BILL, RECYCLING, RETURNABLE

DISPOSABLE - *ITEMS WHICH ARE MADE TO BE USED ONCE AND THROWN AWAY.*
BOTTLE BILL - *LAW OR BILL WHICH WOULD REQUIRE THE USE OF RETURNABLE BOTTLES.*
RECYCLING - *THE ACT OF MAKING NEW MATERIALS OUT OF PREVIOUSLY USED PRODUCTS.*
RETURNABLES - *PRODUCTS WHICH CAN BE USED ONCE AND THEN RETURNED FOR REPEATED USE.*

BEGIN HERE:

You must first inform yourself about these two alternatives. Make sure that you pick at least 2 addresses from column A and 2 from column B on the back.

Write letters to these addresses requesting information on deposit bottles and recycling glass. Ask them for the pros and cons of each alternative.

While you are waiting for responses you can read about and gather information from the following sources:

(1) Readers Guide To Periodical Literature in your library.

(2) Library books on glass, recycling, solid waste management, or on the environment.

(3) Newspaper articles in your local paper.

(4) Visit a recycling plant or bottle factory nearby.

OVER

A

RETURNABLE BOTTLES

States which require deposit bottles:

Vermont, Oregon, Connecticut, South Dakota, Iowa, Maine

Vermont Natural Resource Council
26 State Street
Montpelier, Vermont 05602

Department of Environmental Quality
State of Oregon
1234 S.W. Morrison
Portland, Oregon 97205

Organizations Which Support Deposit Bottles:

National Wildlife Federation
1412 16th Street N.W.
Washington, D.C. 20036

Office of Solid Waste Management
U.S. E.P.A.
401 Main St. S.W.
Washington, D.C. 20460

B

GLASS RECYCLING

Glass Recycling Enterprises, Inc.
Box 212
Berlin, New Jersey

National Industrial Pollution
Control Council
U. S. Government Printing Office
Washington, D.C. 20402

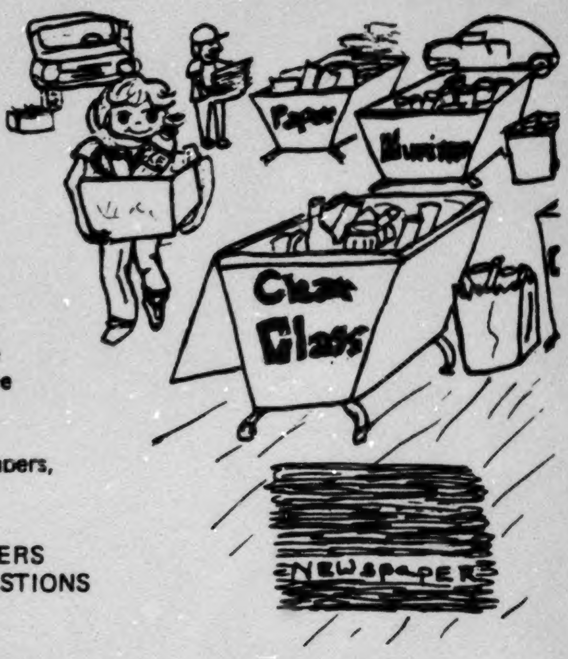
Recycling Educational Services
Division
Rodale Press, Inc.
Emmaus, Pa.

Go to your supermarket and ask people when they come out of the store if they want to see returnable bottles. Ask them if they recycle glass. Ask them why they answered as they did.

What are some of the reasons that people don't want a bottle bill? A recycling program? List and discuss them in class.

Compile a list of the pros and cons for each alternative:

(1) PROS		(2) CONS	
Recycling	Deposit Bottles	Recycling	Deposit Bottles



D2 SOURCE SEPARATE

BIG IDEAS:

Source separation, the separation of reusable and recyclable solid wastes before they are collected and mixed together can save both time and money.

Time is saved because people don't have to resort the materials at the recycling plant. Money is saved because the recycling plant does not have to pay people or run a machine to resort the materials.

Materials that can be easily source separated include newspapers, glass containers, metal containers, and used motor oil.

YOUR JOB IS: SOURCE SEPARATE THE NEWSPAPERS IN YOUR HOME AND ANSWER QUESTIONS ON A STUDY CHART.

MATERIALS

None

BEGIN HERE:

Solid wastes are a big problem not only because dumping grounds and sanitary landfills use valuable space, but because of the depletion of natural resources that cannot be replaced.

Source separation of newsprint and other recyclables in your home can contribute significantly toward easing the shortages of natural resources and cutting disposal costs.

In some communities of Burlington County, New Jersey and elsewhere residents are asked to separate newspapers from other trash collected at the curb. The newspapers are picked up by a private company without cost to the taxpayers. This company sells the newspapers and pays a percentage of the profit to the community. Taxpayers save money. With a 100% participation rate it is estimated that source separating newsprint in the home can prevent approximately 5% (by weight) of municipal solid waste from entering the landfill. This can give the landfill a longer lifetime.

When newsprint is recycled it requires 61% less water, consumes 70% less energy, produces less pollution and generates less solid waste than similar costs required for the production of new paper.

Few people realize that the United States depends on other countries for paper as well as oil. The success of the source separation program will help cut down on this dependence.

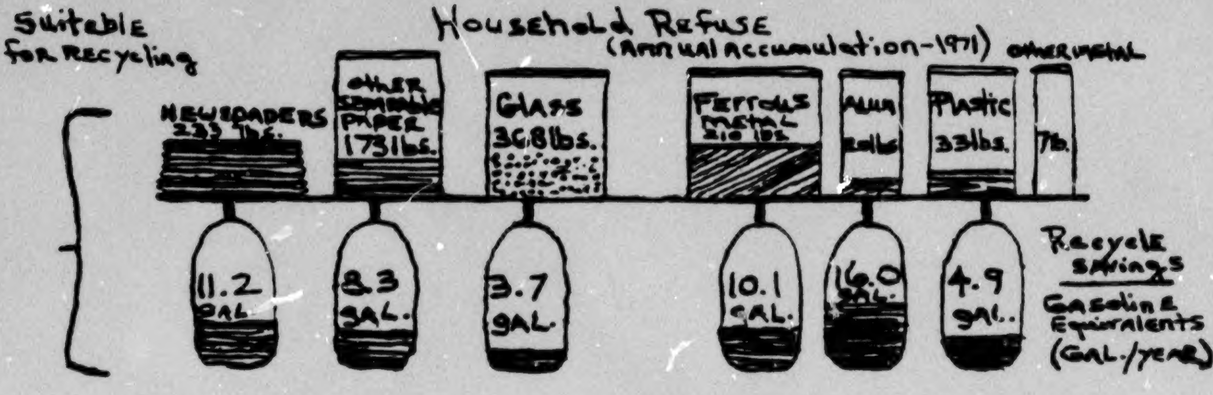
Watch for newspaper articles about source separation programs in your town. Talk it over with your parents and offer to set the newspapers on the curb.

If newspapers are not source separated in your town you can collect and give them to a community organization. They can raise money by collecting and selling newspapers.

NEXT:

Recycling separable items can indirectly save us gallons of gasoline. Study the following diagram and answer the following questions.

OVER



1) Which two items amount to 19.5 gallon equivalents a year?
2) Which item yields the most gasoline equivalent per year for its weight?
3) Which item yields the least amount of gasoline equivalent per year for its weight?

CAN YOU DO THESE?

1) In addition to source separating newspapers you can source separate other solid waste materials in your home such as glass or metal containers, aluminum cans and used motor oil.

2) Talk to your teacher or parents about setting aside two or three containers to contain the glass, aluminum and paper produced by your classroom or school.

3) Below you will find a list of Burlington County drop-off points for recyclable solid wastes. When your containers are filled you may take them to one of the following places. You may know of other drop-off points closer to you.

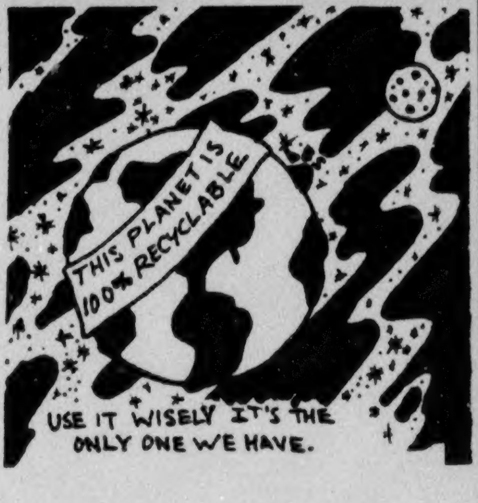
TOWN	SPONSOR	MATERIALS ACCEPTED	COLLECTION METHOD	SCHEDULE
Cinnaminson	Public Works Dept.	Cardboard All Glass Bulk Items Used Motor Oil	Public Works Dept.	Anytime
Evesham	Township	Bulk Metal	Pick-up 609-983-2798	1st & 2nd Friday of every month
Moorestown	Township	All Glass Aluminum Bi-metal cans	Public Works Dept.	Anytime

4) Used Oil

According to available estimates, 24 million gallons of used automotive oil were produced last year (1979) in New Jersey. Used oil has many uses depending on current demand. Many service stations will accept used motor oil from the crank case of your family car.

If you or your parents changethe motor oil in the family car, put it into a plastic milk container (preferably a gallon container with a screwtop) and take it to the closest service station for recycling.

D3 WHAT IF WE RECYCLE STEEL, ALUMINUM AND GLASS?

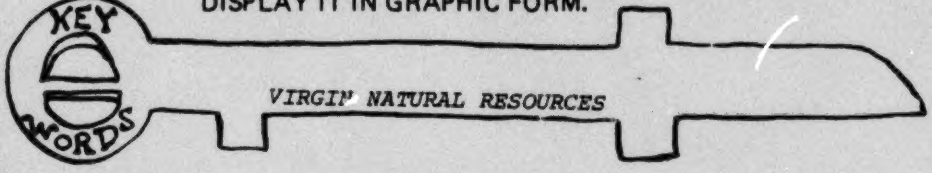

THIS PLANET IS 100% RECYCLABLE
USE IT WISELY IT'S THE ONLY ONE WE HAVE.

BIG IDEA:

Recycling materials such as steel, aluminum and glass can provide money for local communities and conserve energy.

Recycling reduces the amount of virgin natural resources that must be used. It also reduces the solid waste load going to the landfills, thereby increasing their life expectancies.

YOUR JOB IS: TAKE THE INFORMATION PROVIDED ABOUT NEW JERSEY'S RECYCLABLE STEEL, ALUMINUM AND GLASS AND DISPLAY IT IN GRAPHIC FORM.



VIRGIN NATURAL RESOURCES - *MATERIALS FOUND IN THE EARTH WHICH ARE USEFUL TO ALL LIVING ORGANISMS INCLUDING MAN.*

BEGIN HERE:

Many times during your studies or leisure reading you may have seen graphs and tables filled with lines and numbers. How did they get there? What do they tell us? Are they important?

You will find as you grow older that it is essential for you to be able to understand how to read graphs and tables. You will use them while cooking, filling out tax forms or on your job. They are a valuable way of presenting information to people. This lesson involves reading and completing tables and constructing graphs using solid waste information. Read on.

TABLE ONE *

RECYCLABLE MATERIALS IN NEW JERSEY

ESTIMATES IN TONS

YEAR	STEEL CANS	ALUMINUM	GLASS
1975	243,000	61,000	585,000
1980	258,000	64,000	621,000
1985	273,000	68,000	659,000
1990	280,000	72,000	699,000

*From the State of New Jersey Draft Plan on Recycling, June 1980

OVER

Table 1 gives us estimates of the total amount of recyclable steel cans, aluminum and glass in New Jersey for 5 year intervals. This information can also be displayed with graphs. This has been partially completed in figure 1 below. Complete the Figure 1 bar graph. Include the following information: title, legend, source of data, date, your name. Include this information on all graphs that you make. (Note: You may want to look in your math book for information on how to construct graphs).

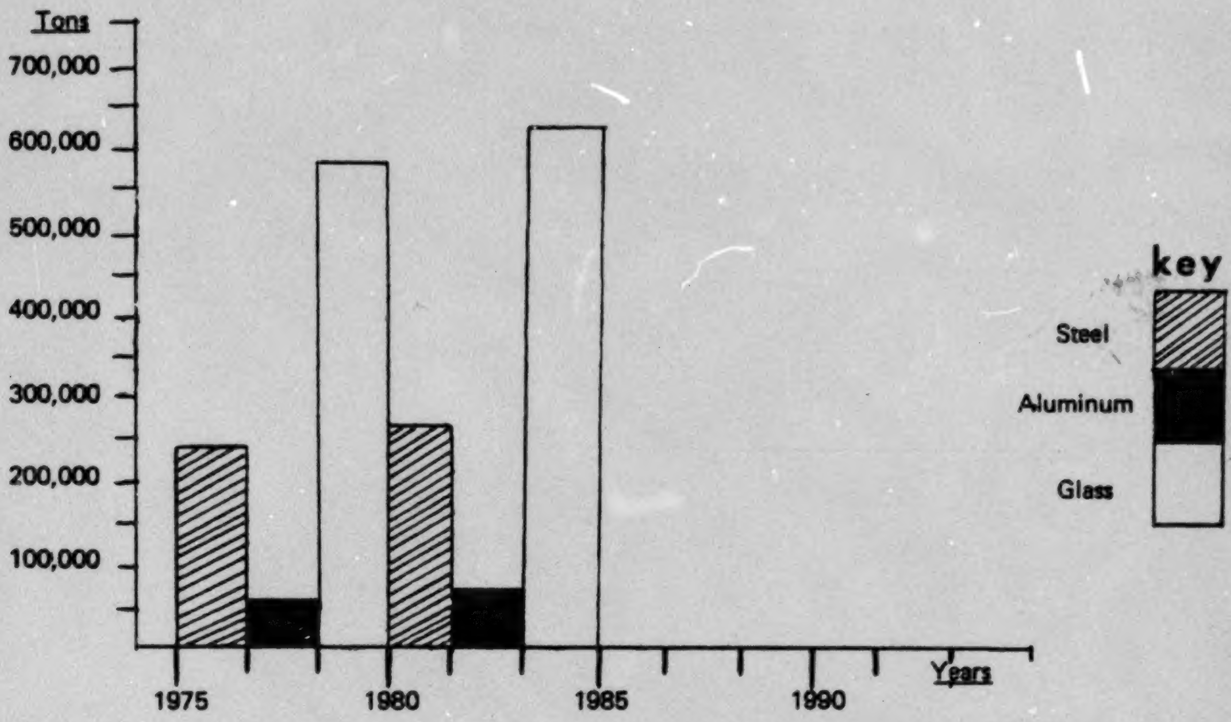


FIGURE 1 RECYCLABLE MATERIALS IN NEW JERSEY

NEXT:

Table 2, when completed, will tell us how much oil can be conserved and what the potential revenue is if different amounts of steel, aluminum and glass are recycled. Finish filling in the information for aluminum and glass.

Figures 3,4 and 5 are cartesian graphs using the information for steel from Table 2. Now make similiar graphs for aluminum and glass.

NEXT:

We can see from our graphs and tables that by recycling steel, glass and aluminum, communities can make money and conserve energy. In addition, recycling would result in reducing the amount of virgin natural resources that would normally be used. Furthermore, it would reduce the total solid waste load going to the landfills. This would increase their life expectancies.

CAN YOU DO THESE?

1) Give a 5 minute presentation to your class explaining what the graphs tell us.

ON YOUR OWN:

To find out more about recycling in New Jersey write:

State of New Jersey
Office of Recycling
101 Commerce Street
Newark, New Jersey 07102

TABLE 2

RECYCLABLE MATERIAL IN NEW JERSEY, POTENTIAL REVENUE, BARRELS OF OIL CONSERVED.

1980 DATA FOR NEW JERSEY

Percent of Total Material Recycled		100	80	60	40	20
Weight In Tons	Steel Cans	258,000	206,400	154,800	103,200	51,600
	Aluminum					
	Glass					
Potential Revenue ($)	Steel Cans ($60.—$80./ton)	$20,640,000	$16,512,000	$12,384,000	$8,256,000	$4,128,000
	Aluminum ($ 600./ton)					
	Glass ($ 25./ton)					
Barrels of Oil Conserved by Recycling	Steel Cans (1.6 barrels/ton)	412,800	330,240	247,680	165,120	82,560
	Aluminum (29 barrels/ton)					
	Glass (.25 barrels/ton)					

Figure 3

Weight of Steel (tons)
vs
Percent of Total New Jersey Steel Recycled

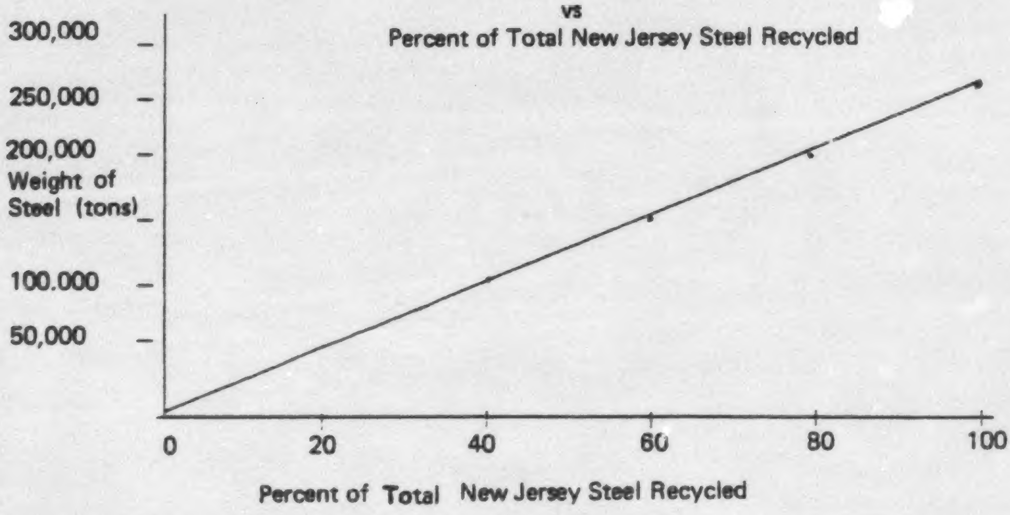


Figure 4

Potential Revenue (Dollars)
vs
Percent of Total New Jersey Steel Recycled

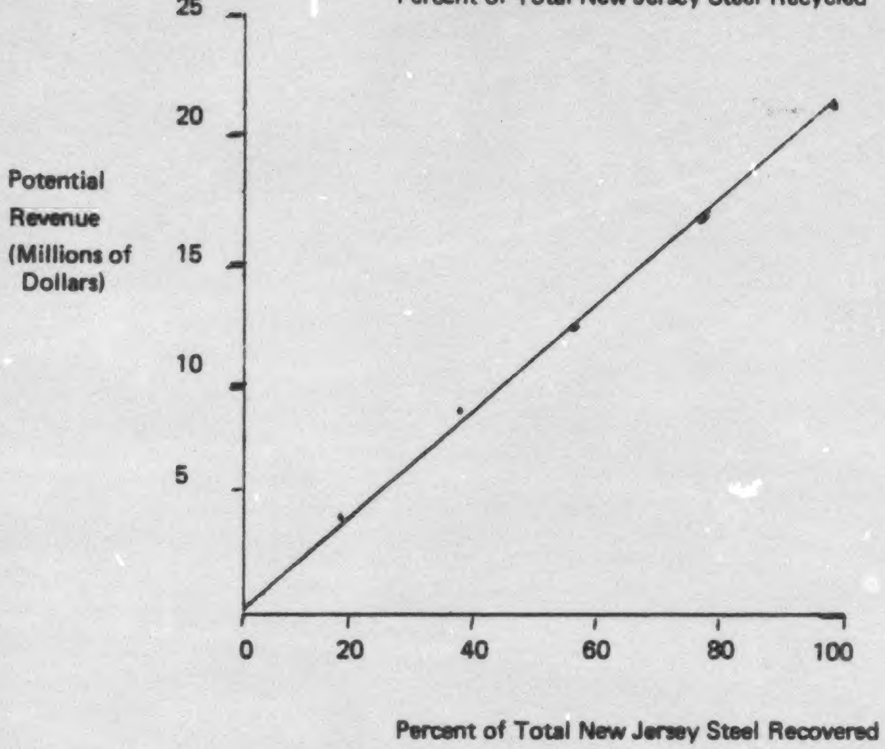
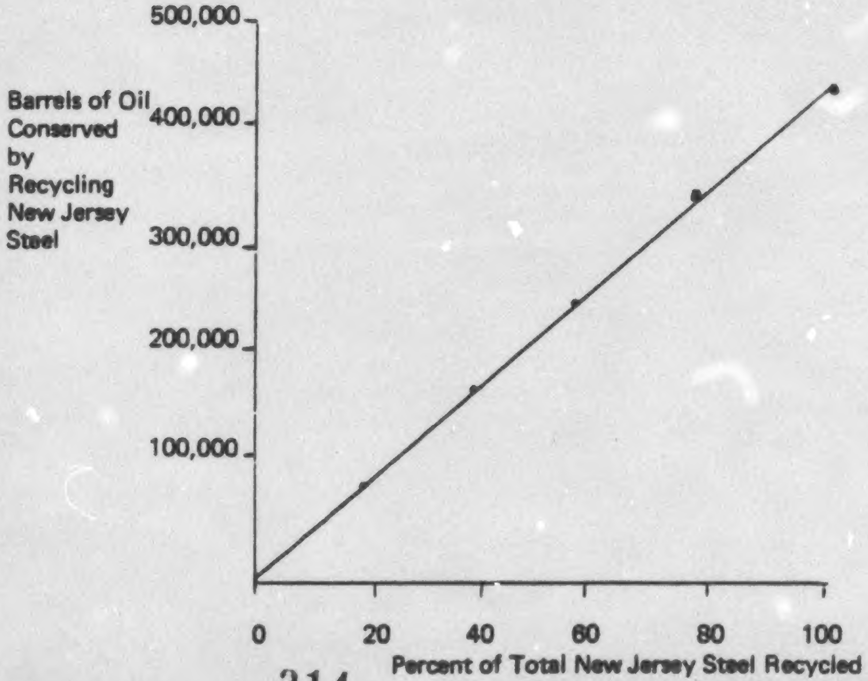


Figure 5

Barrels of Oil Conserved
vs
Percent of Total New Jersey Steel Recycled



D4 BURN GARBAGE FOR ENERGY?

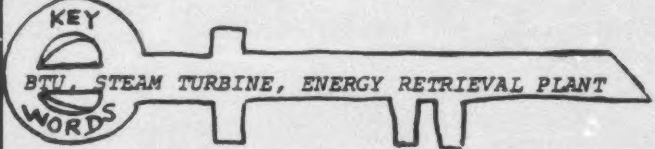
OIL HEAT
DAILY NEWS
EVERLASTING BATTERY
gas

BIG IDEAS:

Presently Americans create more waste than they can deal with efficiently. The Environmental Protection Agency estimates that by 1995 each American will be producing 5.27 pounds of waste everyday.

Possibly as much as 75% of our solid waste can be used as a supplement to coal, oil and natural gas, for use as an energy source.

YOUR JOB IS: BUILD A MODEL STEAM TURBINE BY USING DISCARDED NEWSPAPERS AS A POWER SOURCE.



BTU, STEAM TURBINE, ENERGY RETRIEVAL PLANT

MATERIALS

1) Permission from your teacher
2) Can with tight cover
3) Piece of cork ¼ inch thick
4) Two pieces of cardboard (a) One piece 5"X5" for paddles
   (b) One piece 8"X2" for support.
5) Two pins for axles
6) Two weeks supply of newspaper
7) Barbecue pit.
8) Hammer

BTU - BRITISH THERMAL UNIT - A MEASURE OF THE QUANTITY OF HEAT NEEDED TO RAISE THE TEMPERATURE OF ONE POUND OF WATER (ABOUT 2 CUPS) ONE DEGREE FAHRENHEIT.

STEAM TURBINE - A FAN BLADE WHEEL WHICH CONVERTS STEAM TO ROTARY MOVEMENT.

ENERGY RETRIEVAL PLANT - A PLANT WHERE ENERGY IS RECOVERED FROM WASTE MATERIALS.

NOTE:

For this lesson you will be using newspapers. However, other solid waste materials such as cloth, combustible food waste, cardboard and plastics can also be used, when burned properly, as a supplement to oil, coal, and natural gas.

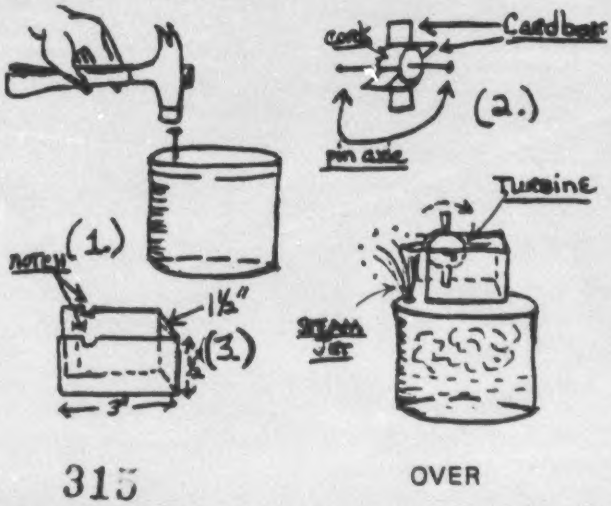
Some people think that burning solid wastes to provide energy is not the answer to either the energy crisis or to the solid waste problem. Some reasons for this are:

1) The cost of building and maintaining an energy retrieval plant is very high.
2) Additional energy is used to separate burnable waste from nonburnable waste.
3) Loss of job opportunities in the recycling industry and at sanitary landfills.
4) The cost of collecting enough waste to make an energy producing plant economical.
5) Air pollution from incineration.
6) The loss of materials that could be recycled and reused.

After completing this lesson maybe you can decide if burning solid wastes is a good solution to the solid waste disposal dilemma. (See NO. 6, CAN YOU DO THESE?)

BEGIN HERE: BUILDING YOUR TURBINE*

1) Find a can with a tight cover and punch a small nail in the cover ½ inch from the edge. Fill the can with water.
2) To make the turbine, cut a round slice of cork about ¾ inch thick, insert four 1" X ¾" cardboard paddles in ¼ inch slits in the cork, and use two pins for axles.
3) To make a support for the turbine, cut a piece of cardboard 7½"X1½", bend it as shown, and cut two notches to hold the pin axles.



* Adapted from —Science Experiences with Home Equipment
Carleton John Lynde, Ph.D

OVER

4) You will need at least a 2 week supply of newspaper.

5) You will want to roll your newspapers into newspaper logs. (This will enable the newspaper to burn longe

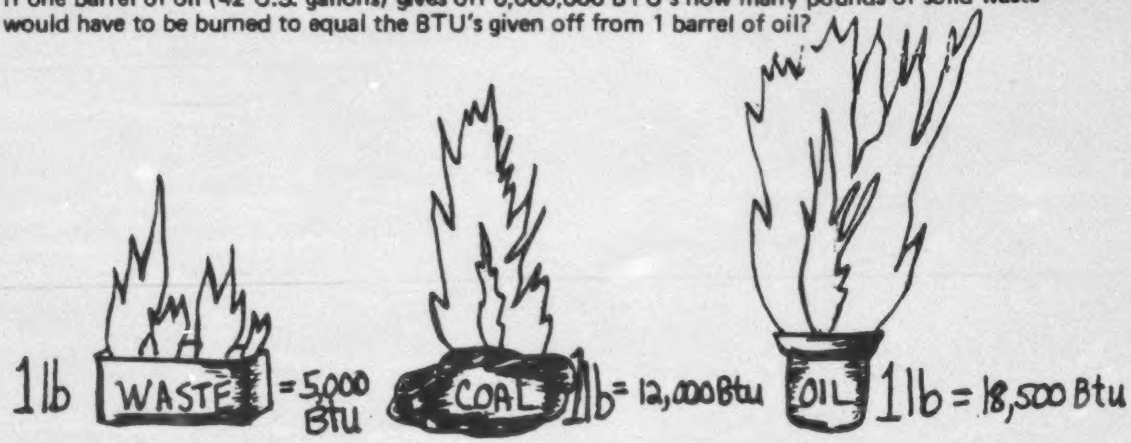
6) Get permission to light the paper in the school yard; or use a chemical fume hood if one is available in the school laboratory.

7) Place your newspaper logs in a barbecue pit. Light your newspaper logs. Once the paper has started to generate enough heat, place your can with the turbine on top of the grill.

8) As the water in the can boils, you will see the steam jet spin the turbine very rapidly.

CAN YOU DO THESE?

1. Today's typical pound of solid waste contains a heat energy potential of about 5,000 BTU's. By comparison one pound of coal gives off 12,000 BTU's and one pound of oil gives off 18,5000 BTU's.
2. If one barrel of oil (42 U.S. gallons) gives off 6,000,000 BTU's how many pounds of solid waste would have to be burned to equal the BTU's given off from 1 barrel of oil?



3. The average American generates about 4 lbs. of waste a day. How many pounds of solid waste would a town of 4,000 people generate?
4. How many barrels of oil could a town of 4,000 people save each day if they burned their solid waste?
5. How many barrels of oil could your town save each day? (Check your town's population at the town hall)
6. Conduct some class discussions as to whether burning paper for energy or recycling to make new paper is better when:
   a) You live in a city which already has 3 incinerator plants.
   b) You live in an area where trees are lumbered to produce wood pulp for paper making.
   c) You live in a place where coal or other fuels are extracted from the earth.
   d) The cost of coal and other fuels rise sharply.
   e) The cost of paper rises sharply.
   f) Other situations which you may think of.

ON YOUR OWN:

This lesson deals with only newspapers as a power source. If you would like to get a better understanding of how burning solid waste creates energy, write away for information on energy retrieval plants to:

National Center Resource Recovery
1211 Connecticut Ave. N.W.
Washington, D. C. 20036

*AFTER CARRYING OUT THE 4 TASKS IN THIS WHAT IF UNIT
THE STUDENTS WILL BE ABLE TO:*

	TASKS WHICH MEET THESE OBJECTIVES
1. Identify and discuss 2 or more of the pros and cons of recycling glass and using returnable bottles.	1
2. Identify 2 or more solid waste materials that can be source separated.	2
3. Discuss at least 2 reasons why source separation and recycling of solid waste is beneficial to people.	2,3
4. Take information from tables and/or charts and display it in graphic form.	3
5. Build a model steam turbine.	4
6. Identify 2 or more solid waste materials which, when burned properly, could be used as a fuel supplement to coal, oil and natural gas.	4

GLOSSARY

BOTTLE BILL - LAW OR BILL WHICH WOULD REQUIRE THE USE OF RETURNABLE BOTTLES.

BRITISH THERMAL UNIT (BTU) - A MEASURE OF THE QUANITITY OF HEAT NEEDED TO RAISE THE TEMPERATURE OF ONE POUND OF WATER (about 2 cups) ONE DEGREE FAHRENHEIT.

DISPOSABLE - ITEMS WHICH ARE MADE TO BE USED ONCE AND THROWN AWAY.

ENERGY RETRIEVAL PLANT - A PLANT WHERE ENERGY IS RECOVERED FROM WASTE MATERIALS.

RECYCLING - THE ACT OF MAKING NEW MATERIALS OUT OF PREVIOUSLY USED PRODUCTS.

RETURNABLES - PRODUCTS WHICH CAN BE USED ONCE AND THEN RETURNED FOR REPEATED USE.

STEAM TURBINE - GENERATOR THAT PRODUCES STEAM BY HEATING WATER.

VIRGIN NATURAL RESOURCES - MATERIALS FOUND IN THE EARTH WHICH ARE USEFUL TO ALL LIVING ORGANISMS; INCLUDING MAN.

CESC
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TEACHER GUIDE

D1 RETURN TO RETURNABLES OR RECYCLE GLASS?

PROS RECYCLING & DEPOSIT BOTTLES	CONS RECYCLING & DEPOSIT BOTTLES
Energy savings	Reduced tax revenues
Conserves resources	Inconvenience
Reduce litter	Curtailment of consumer freedom
Possible lower prices for consumers	Job losses (at container manufacturing level)
Job increases (at retail & distribution centers)	
Tends to return customers to same stores	

D2 SOURCE SEPARATE?

1. Newspapers and other separable paper
2. Aluminum
3. Glass

D4 BURN GARBAGE FOR ENERGY?

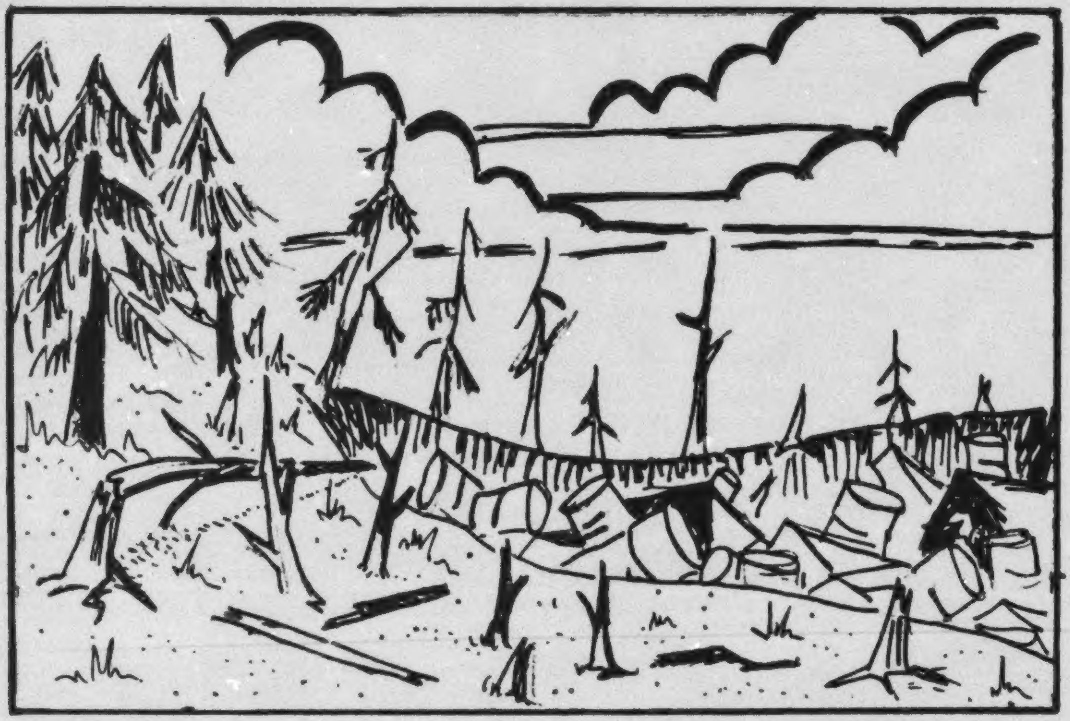
(CAN YOU DO THESE?)

2. 1,100 pounds of solid waste.
3. 16,000 pounds of waste each day.
4. 14.5 barrels of oil each day.

D3 RECYCLE STEEL, ALUMINUM AND GLASS?

TABLE 2
RECYCLABLE MATERIAL IN NEW JERSEY
POTENTIAL REVENUE, BARRELS OF OIL CONSERVED.
1980 DATA FOR NEW JERSEY

	Percent of Total Material Recycled	100	80	60	40	20
Weight In Tons	Steel Cans	258,000	206,400	154,800	103,200	51,600
	Aluminum	64,000	51,200	38,400	25,600	12,800
	Glass	621,000	496,800	372,600	248,400	124,200
Potential Revenue ($)	Steel Cans ($80./ton)	$20,640,000	$16,512,000	$12,384,000	$8,256,000	$4,128,000
	Aluminum ($600./ton)	38,400,000	30,720,000	23,040,000	15,360,000	7,680,000
	Glass ($25./ton)	15,525,000	12,420,000	9,315,000	6,210,000	3,105,000
Barrels of Oil Conserved by Recycling	Steel Cans (1.6 barrels/ton)	412,800	330,240	247,680	165,120	82,560
	Aluminum (29 barrels/ton)	1,856,000	1,484,800	1,113,600	742,400	371,200
	Glass (.25 barrels/ton)	155,250	124,200	93,150	62,100	31,050



So many people say that they love the New Jersey Pine Barrens (Pinelands), but there seem to be many different ways of expressing this sentiment. For a long time the Pinelands were not much loved, else why would they be called the Barrens? They seemed to be desolate, useless or destined to be an area of failure for human endeavor.

EARLY PINE BARRENS INDUSTRIAL LAND USE

There is a long list of industries that first flourished and later failed in the Pinelands. Deposits of bog iron were utilized from the late 1700's to the mid-1800's. The abundant firewood and high quality iron produced made the industry competitive until lower cost coal production shifted iron and steel manufactures to Pittsburgh and further west.

The fabrication of hand-blown glass developed both in and outside the Pine Barrens. After the advent of machine methods for glass making, the hand-blown glass industry survived in New Jersey outside the Pine Barrens in places like Clayton and Elwood. In the 1860's the papermaking industry began in the Pinelands. The abundant pine pulpwood supply and the tea-colored waters of the ever-flowing streams sparked the new enterprise. Unfortunately the combination of iron and tannins giving the Pine Barrens water its reddish brown color made the paper too yellow. As the demand for yellowish paper fell off, the industry and the towns that grew up around the paper mills all vanished by the 20th century. The making of charcoal and the manufacture of clay pipe (terra cotta) were also one-time Pinelands industries, now gone.

Pulpwood lumbering and the gathering of cedar poles for docks and bulkheads still persist as a livelihood for a few people, although peat moss gathering has nearly died out. The gathering of white birch twigs and poles, grape vines and other plant products still employs a few persons.

PINELANDS AGRICULTURE

Two unique agricultural industries have sprung up in the hitherto unproductive Pine Barrens during the last century - cranberry culture and blueberry growing. Cranberries have been grown in diked sandy fields since the 1850's The fields with their reservoir ponds and feeder canals were dug by hand using people power and horse power. By 1900 more than 6000 acres of cranberry bogs (fields) had been put into production. Less than 3000 acres are in active culture today. Blueberry culture was originated in the Pine Barrens in 1912 by Elizabeth White and Frederick Coville in Whitesbog near Browns Mills. Many of the blueberry fields were planted in converted cranberry bogs.

For a time thousands of persons were seasonally employed for the harvesting of cranberries and blueberries, but, like all agriculture, the high dependence on mechanical planters, sprayers and harvesters has reduced the great numbers of seasonally employed to a few hundred year-round employees working for a handful of well-to-do farmer landowners.

MODERN PINE BARRENS INDUSTRIES

Sand and gravel mining is an important modern day Pinelands industry. Every one of the 52 Pinelands towns has or did have one or more sand-gravel extraction sites. Ilmenite, an ore of titanium, is extracted from sand at Manchester for use as a paint pigment. Some of these extraction sites have become barren eyesores while others have been reclaimed as attractive home building sites with ponds or lakes as an added attraction.

Recreation in the Pine Barrens grows larger each year. Swimming, camping, and picnicking facilities for the public are being expanded by the Bureau of Parks and Recreation within the N.J. Department of Environmental Protection. Hunting on public and private lands continues to grow with the rise and increase of the more than 100 gunning clubs in the Pine Barrens. Hikers and off-road vehicles sometimes compete for trailways as the number of persons participating grows. Similarly the growth of Pine Barrens streams canoeing makes weekends quite busy on the watery trailways formed by Pine Barrens streams.

THE HOUSING PRESSURE

As population in western New Jersey and on the coastline began to overflow, the Pinelands became attractive for residential development. One use for abandoned cranberry and blueberry fields is for producing lakeside homesites. This practice began notably at Medford, Hampton, Presidential and Lebanon Lakes. Today there are probably more acres of abandoned cranberry bogs than those still under cultivation. More are being used as lakes for residential development. The number of new housing sites has grown most rapidly in eastern Ocean and in western Burlington Counties.

MOVING TO SAVE THE PINE BARRENS

The threat of a super airport in southeastern Burlington County in the 1960's spurred many groups interested in preventing the complete development of the Pine Barrens. Among these were the Pine Barrens Conservationists who with others joined to form FOCUS (Federation of Conservationists, United Societies). From their effort came state legislation to form the Pinelands Environmental Committee. Discontent with the Committee's lack of success in controlling the land use in the Pine Barrens, ultimately brought about the appointment of the Pinelands Commission by Governor Brendon Byrne following a legislative act stating one responsibility of the Commission is preserving the reported 17 trillion gallons of underground water stored in Pine Barrens aquifers. The N.J. Department of Environmental Protection had already designated a large central Pine Barrens area as a critical water zone with special surface and under-

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ground water standards. This forbade land use which would pollute these waters.

One of the most feared pollution sources was the vast number of septic tanks appearing with all new homes. Studies by a Rutgers University research group headed by Professor Lloyd Douglas in Bass River Township, showed that the critical area could possibly tolerate only 20 septic tank systems in a single square mile area or one to every 3.2 acres. The Pinelands Commission under its legislated powers has zoned most of the Pine Barrens with this septic tank limitation in areas zoned forest, agricultural or rural growth areas. Only one in 39 acres is permitted in the central critical water area section now zoned as the Pinelands Preservation Zone by the Commission.

WATER PIRATES

In 1841, the well-known financier Joseph Wharton purchased a large sector of Pine Barrens lands in Camden, Burlington and Atlantic Counties. He thought that this water-rich area would be tapped for the use of a city like Philadelphia. The New Jersey Legislature subsequently forbade the exportation of water from New Jersey. The large tract is now Wharton State Forest. In the last decades as water shortages have been more widespread, the request for water exportation from South Jersey to North Jersey has again been voiced. Many people believe that the Pinelands would be permanently and adversely affected by a heavy drawdown of the underground waters of the Pine Barrens, while others say that large water withdrawals can be made without harmful effect. Still others say that the populations in the northern megalopolis have a right to water from anywhere in New Jersey.

THE DELUGE OF TRASH AND TOXIC WASTES

Human kind has always preferred to throw its wastes on the ground or in holes in the ground. Today we call them landfills. The lovely open stretches of the Pine Barrens now became the site of a new , often illegal industry - dumping of industrial solid wastes and chemical wastes not permitted elsewhere. Low costs and much available space were probably the two most influential reasons for this practice. New Jersey's Pinelands became importers of Philadelphia's and other cities' trash. The number one industry in New Jersey is the chemical complex. Most of its waste materials are buried or stored in New Jersey, many in the Pine Barrens; some was buried with permits and some without permits. Some waste chemicals even came from out of state.

Poisonous chemicals are known to have already entered the water in the Pinelands' underground supply.

WHAT TO DO?

Research the issues. The issues are redefined here. You may wish to redefine them or add new ones. Use the bibliography provided with each issue.

ISSUE NO. 1 FEAR OF TOXICS

The newspapers and the television newscasts and documentaries have provided both facts and accusations about the polluting or poisoning of the water of the Pinelands' underground reserves. Many people are frightened; others have had to receive emergency water rations by tank truck to replace their poisoned underground water sources; still others fear the pollution of the entire underground water body in the Pinelands.

There are disputes concerning the opening of new landfills, the closing of landfills and what has been placed or should be placed in them. It seems that nobody wants to have a landfill as a neighbor. What do you think about this problem? Get information to make an accurate assessment of the safety of the Pinelands' water supply.

Sources Of Information:

Every metropolitan daily newspaper has a classified news clipping file called a morgue. Send a committee of two or three persons to find articles printed in the last two years. For example:

The Press, Atlantic Avenue,
Atlantic Avenue,
Atlantic City, N.J. June 11, 12, 13

The Asbury Park Press
64 Washington Street
Toms River, N.J. 08753

The Bulletin
30th and Market Sts.
Philadelphia, Pa.

The Inquirer
400 N. Broad St.
Philadelphia, Pa.

Use the Comprehensive Management Plan published by the Pinelands Commission, State of New Jersey, Department of Environmental Protection, in 1980. There are copies in most municipal libraries and in the clerk's office of Pinelands municipalities.

Use the analysis of the Pinelands Comprehensive Management Plan prepared by the United States Department of the Interior. It is available in the same places (repositories), and also at:

Northeast Regional Office
Heritage Conservation and Recreation Service
U.S Department of Interior

Final Environmental Impact Statement
Proposed Comprehensive Management Plan
for the Pinelands National Reserve

This document has an excellent bibliography.

ISSUE NO. 2 ANGRY AT BIG BROTHER

Since the publication of George Orwell's novel 1984, the term "big brother" means govenment control. The Pinelands Comprehensive Management Plan is probably the newest and most innovative regional control plan in the United States. Under these regulations,the 52 municipalities whose land areas are wholly or partially within the jurisdiction of the Commission must modify their master plans to conform with the Comprehensive Manangement Plan. The Commission has offered to supply funds to each municipality for this purpose. Without conformity in its master plan, each community in the Pinelands would have to abide by the Commission's decisions for all land use development or projects. This greatly weakens the local control or Home Rule which is traditional in New Jersey and elsewhere in the United States. Get information to organize the arguments on both sides. Perhaps you may wish to organize a debate with 3 or 4 persons representing regional land use control vs. local control (Home Rule). One way to measure the effectiveness of either is to find out how well each system works in actual practice.
For information:

Use the same sources as for Fear of Toxics.

In Addition:

Send for a publication on theAdirondack Mountains Regional Control Commission from the New York State Department of Conservation, Albany, New York

Talk to your local and county planning officials and write to Congressman Florio (pro) or Congressman Hughes or Forsythe (con).

ISSUE NO. 3 EXPORTING WATER

Stephen Warren writing for The Press, Atlantic Avenue, Atlantic City, N.J. 08400, recently summarized the arguments about using water from the Pinelands, February 26, 1981. Research the pros and cons and try to get answers for these questions:

To what extent would the Pinelands water, if used, relieve the current shortages which developed in 1980-81, in North Jersey?

Would the ecology of the Pinelands be adversely affected by a heavy underground water withdrawal?

Would the bays and estuaries such as Barnegat, Little Egg Harbor, Great Bay, Great Egg Harbor and others, including the Deleware Bay, be adversely affected as some people claim?

For information use the same ones and:
Foreman, Richard T.T.,
The Pine Barrens Ecosystem and Landscape
Simon Schuster
New York 1979

Have one person write to:
New Jersey Department of Environmental Protection
Division of Water Resources
P.O.Box CN029
Trenton, N.J. 08625

New Jersey Conservation Foundation
300 Mendham Road
Mendham, N.J. 07945

ISSUE NO. 4 RESTRICTING BUILDING

The new Pinelands Comprehensive Management Plan sharply restricts the number of residential and industrial buildings in the Preservation Area (1 in 39 acres) and in the rest of the Pine Barrens (1 in 3.2 acres) with the exception of designated towns, villages and regional growth areas. Land investors, home builders and agricultural land owners have formed groups opposed to this plan and its new regulations. Some want no restrictions, others say that regulations should be confined to the inner Preservation Zone.

To get more information on this issue for debate or a report use all of the references cited above. In addition you may try:

Boards of Freeholders (for each County)
Home Builders' League of South Jersey
2001 D, Greentree
Executive Campus
Marlton, N.J. 08053

Coalition to Save Agriculture
Gateway 1
Newark, N.J. 07102

ISSUE NO. 5
LAND USE DISPUTES ARE EVERYWHERE

As growing population uses more and more land the questions of highest and best use of the land clash against the needs of people and their real or imagined rights. You may wish to compare or contrast the Pinelands land use controversies with similar problems in:

- The Florida Everglades
- MX Missile Sites in Colorado, Utah and New Mexico
- The Adirondack Mountain Regional Commission
- Using National Forests and Parks for Oil and Uranium
- The Sagebrush Rebellion
- The Alaskan Pipeline

Use the Reader's Guide to Periodic Literature to find out more about these.

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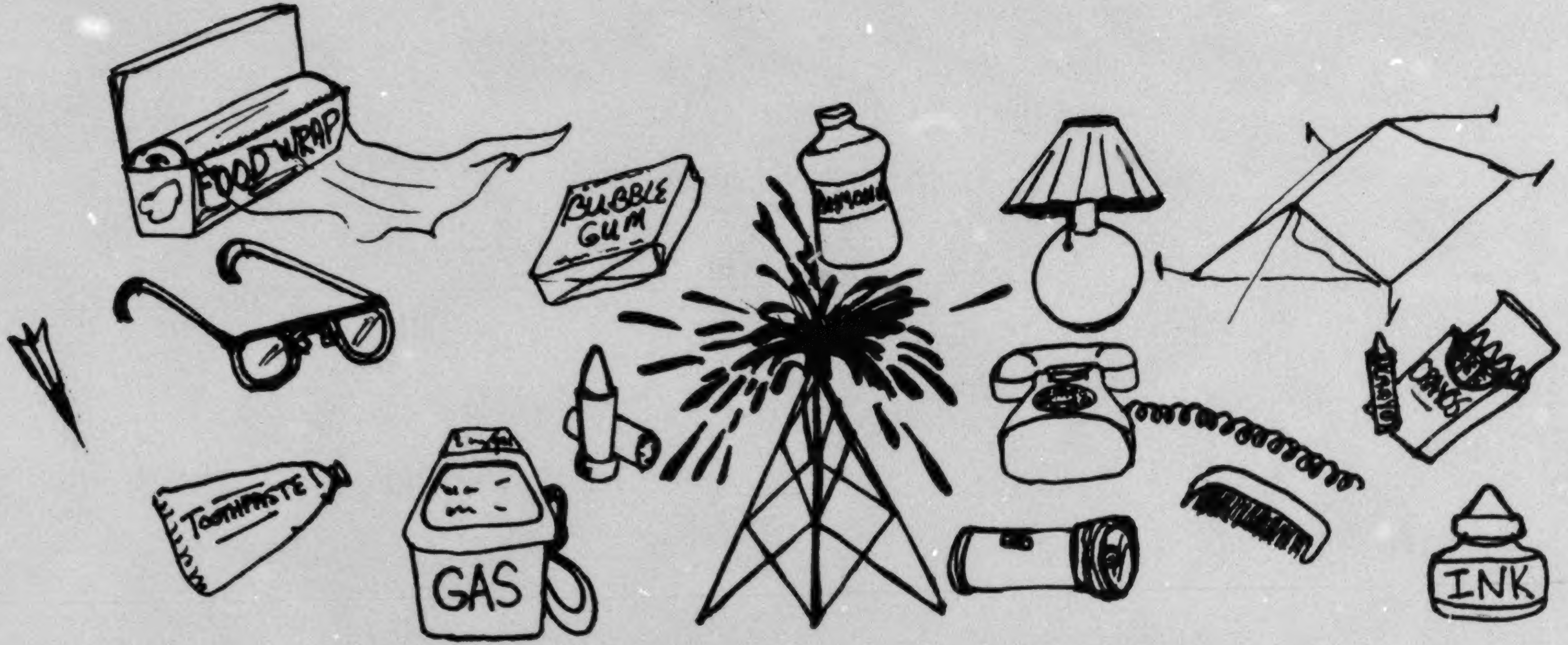
The use of crude petroleum for gasoline, oil and other fuels consumes a large proportion of its total production. However, crude petroleum is also needed for the production of pharmaceuticals, plastics, dyes, chemicals, and many items we use everyday.



As we watch prices rise at gas pumps and home heating bills escalate, many of us think that petroleum is used solely for fuel. Just try to picture a modern world without synthetic materials. Ignored by many economists and analysts are the non-fuel uses of oil. Synthetic materials such as disposable plastic bottles and lighters have been considered malignant symbols of our "throw-away" society. Synthetic rubber, fiber, plastic, fertilizer, medicine, and pesticides are just a few of the many items produced from crude petroleum.

We may be able to convert cars to operate on propane or alcohol fuel, heat buildings with solar energy and produce electricity with wind energy but we have no alternatives to the use of oil as a raw material or base for many of the synthetic products we use everyday.

Crude petroleum is the natural raw material for the growing petrochemical industry. This industry makes vast amounts of pesticides, soaps, medicines, pharmaceuticals and other basic chemical substances. It also provides the raw materials for the production of many synthetic fibers, plastics and rubbers.

Did you know that all of these items are produced from petroleum (oil)?

antenna cable
credit cards
permanent-press clothes
heart valves
crayons
disposable diapers
parachutes
telephones
enamel
transparent tape
vinyl siding
safety flares
bubble bath
bookends
deodorant
panty hose
bedspreads
plastic tubs
shag rugs
lunch boxes
jerseys
windshield wipers
card tables
ping pong paddles
purses
weed killers
football pads
puzzles
mascara
model planes

dishdrainers
puppets
upholstery
hearing aids
earphones
whistles
clothesline
carpet sweepers
chess boards
yardsticks
slip covers
patio screens
mats
refrigerator linings
floor wax
phonographs
car sound insulation
garment bags
fences
kitchen counter tops
pillows
dune buggy bodies
checkers
soap dishes
syringes
shoes
volley balls
sleeping bags
electrician's tape
insect repellent

carbon paper
flags
oxygen masks
ink
hair spray
steering wheels
food wraps
rubber duckies
seed tape
panelling
earrings
false eyelashes
no-wax floors
golf balls
lighter fluid
attache' cases
wet suits
laxatives
trash cans
brassieres
acrylic paints
vacuum bottles
bearing grease
rafts
sockets
tiles
air conditioners
wallets
backpacks
fishing net

rubbing alcohol
epoxy glue
oil filters
mailboxes
uniforms
pacifiers
cassette tapes
luggage
antifreeze
flashlights
motorcycle helmets
antibiotics
shower doors
sugar bowls
decoys
tobacco pouches
pencils
model cars
garden hoses
lawn sprinklers
playing cards
dolls
bubble gum
coasters
straps
tires
rulers
lamp shades
skateboard wheels
hair coloring

guitar strings
jugs
eyeglasses
vinyl tops
TV cabinets
measuring tape
water softeners
microfilm
tennis balls
measuring cups
dishwashing liquid
extension cords
combs
plastic varnish
badminton birdies
bird feeders
hair curlers
laminates
visors
tennis rackets
canisters
computer tape
boat covers
unbreakable dishes
toothpaste
tents
finger paints
glycerin
foot pads

lamps
ice cube trays
swimming pool liners
rubber cement
cough syrup
hair dryers
styrofoam cooler
brake fluid
draperies
car battery cases
hockey pucks
fertilizers
knitting yarn
sandwich bags
table clothes
toothbrushes
darts
flea collars
stadium cushions
hang gliders
sandals
lipstick
electric blankets
ammonia
gaskets
monkey bars
venetian blinds
digital clocks
life jackets

Petrochemical synthetics in excess of 10 million tons were produced in 1960. In 1979, the amount climbed to 80 million tons. Today, 33% of all textile fibers used in the world and 70% of all rubber goods produced are synthetic. Plastics have replaced almost everything from paper bags to grass on football fields. Large supplies of petrochemical fertilizers have aided total world food production and have helped to reduce malnutrition and starvation. It is difficult to find fabrics made out of 100% cotton these days. The chances are that the garment you are wearing has a percentage of synthetic fibers in it such as polyester, dacron or nylon.

YOUR JOB IS:

Divide up into groups of six people. Each person in each group may be assigned to complete one of the following tasks:

1. Write a letter to a major oil company such as Exxon, Mobil, etc.... asking for:
   - a copy of the annual stockholders report.
   - statistics on the percentage of oil used for non-fuel purposes.
   - figures on the total amounts of oil used for fuel and synthetic products.
2. Write letters to both the Department of Energy and the American Petroleum Institute asking for predicted estimates on world crude oil production and OPEC predicted production.
3. Write a letter to a major petrochemical company asking for information on the costs of synthetic products.
4. Analyze the responses from items 1, 2, & 3 and summarize the results in an oral report to the rest of the class. Look over the enclosed list of oil-based synthetic products. Pick out 20 of them and write a short story describing what your life would be like without them. Which ones do you believe are the most important? What would happen if our oil supply is reduced or eliminated? Are there any substitutes? Suggest some.
5. Draw posters to illustrate the non-fuel uses of oil. You may display them throughout the school to make other students aware of your class project.
6. Write letters to your school and local papers to inform other people about the importance of the non-fuel uses of oil.

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ON YOUR OWN:

Organize field trips to petrochemical plants, oil refineries, chemical companies and other synthetic companies. These are good methods of familiarizing yourself with their operations.

ADDRESSES

Major Oil Companies

Amerada Hess Corp.
1185 Avenue of the Americas
New York, N.Y. 10019
212-997-8500

Ashland Oil, Inc.
1401 Winchester Avenue
Ashland, KY 41101
606-329-3333

Atlantic Richfield Co.
515 South Flower Street
Los Angeles, CA 90071
213-486-3511

Department of Energy
101 Commerce Street
Newark, New Jersey 07102

American Petroleum Institute
2101 L Street, Northwest
Washington, D.C. 20037

Cities Service Co.
Cities Service Building
P.O. Box 300
Tulsa, OK 74102

Exxon Corp.
1251 Avenue of the Americas
New York, N.Y. 10020
212-398-3000

Getty Oil Co.
3810 Wilshire Boulevard
Los Angeles, CA 90010
213-381-7151

Gulf Oil Corp.
Gulf Building
Pittsburgh, PA 15230
412-263-5000

Mobil Corp.
150 East 42nd Street
New York, N.Y. 10017
212-883-4242

Pennzoil
P.O. Box 2967
Houston, TX 77001
713-236-7878

Phillips Petroleum Co.
Phillips Building
Bartlesville, OK 74004
918-661-6600

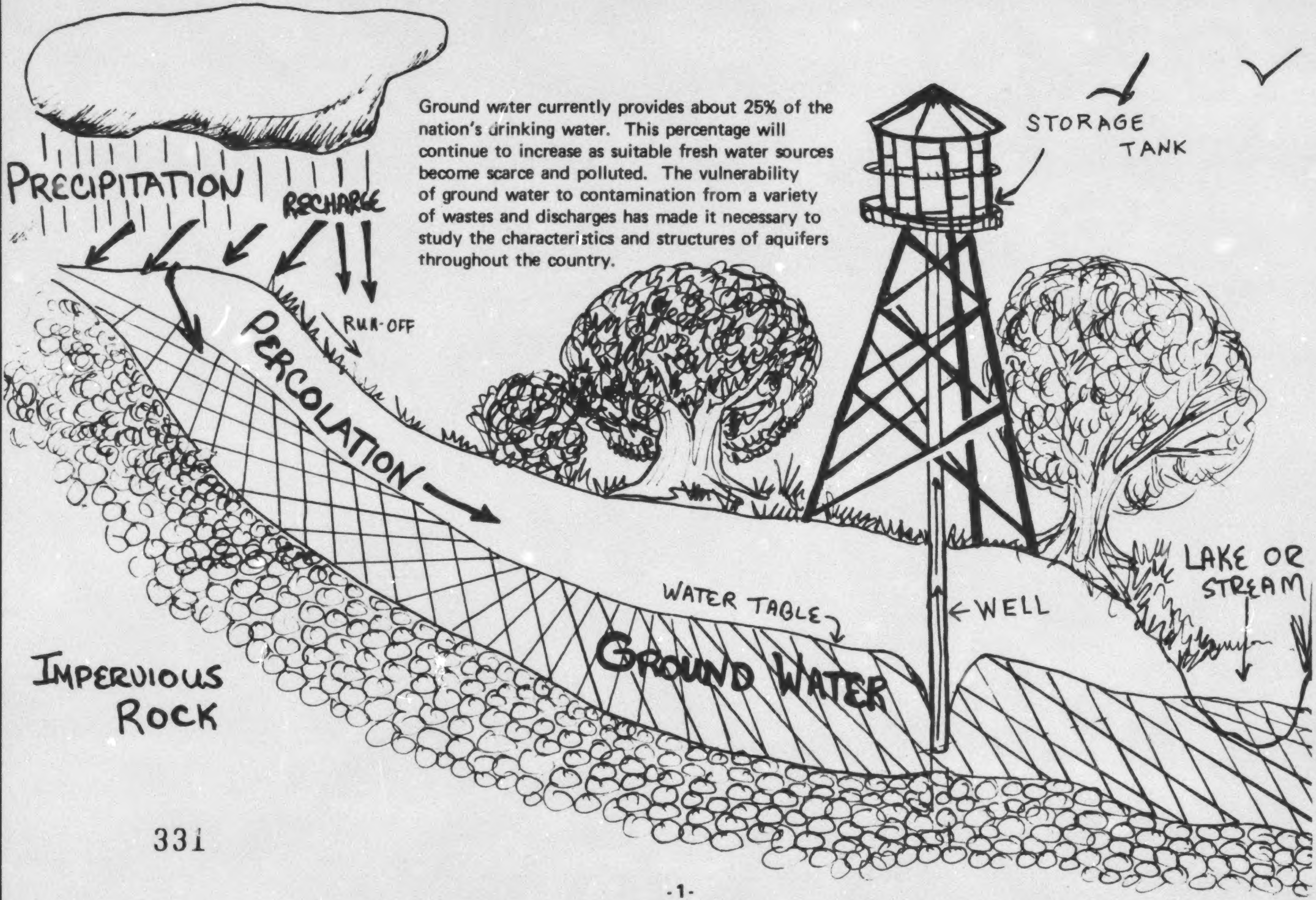
Quaker State Oil Refining Corp.
255 Elm Street
Oil City, PA 16301
814-676-0661

Shell Oil Co.
One Shell Plaza
P.O. Box 2463
Houston, TX 77001
713-241-6161

Sun Co., Inc.
100 Matsonford Road
Radnor, PA 19087
215-293-6368

Texaco Inc.
2000 Westchester Avenue
White Plains, N.Y. 10650
914-253-4000

Ground water currently provides about 25% of the nation's drinking water. This percentage will continue to increase as suitable fresh water sources become scarce and polluted. The vulnerability of ground water to contamination from a variety of wastes and discharges has made it necessary to study the characteristics and structures of aquifers throughout the country.


PRECIPITATION
RECHARGE
RUN-OFF
PERCOLATION
STORAGE TANK
LAKE OR STREAM
WELL
WATER TABLE
GROUND WATER
IMPERVIOUS ROCK

Ground water is held in layers of stone, clay, silt or sand under the ground surface. These layers or geologic strata are called aquifers. The composition of the geologic strata directly affects the movement of the ground water contained in them. For example; water moves more quickly through sand than it moves through clay. See the following Table 1:

TABLE 1. PERMEABILITY OF VARYING GEOLOGIC STRATA

Solid Rock		Unconsolidated Rock
limestone caverns	↑	
jointed lava beds		
limestone	High Permeability	gravel
sandstone		sand
shale	Low Permeability	silt
granite		marl
metamorphic rock	↓	clay

Ground water can be contaminated from any of the following sources:

- *septic tanks*
- *storm sewers*
- *animal feed lots*
- *pipeline leaks*
- *storage tank leaks*
- *waste lagoons*
- *spills*
- *injection wells*
- *land disposal of sludge (land farming)*
- *insecticides*
- *fertilizers*
- *mine drainage*
- *leachate from landfills*
- *sea water intrusion*
- *salt from highways*
- *contaminated rivers and lakes*
- *used irrigation water*

The degree of ground water contaminated is affected by:

1, *Depth of the water table.* If the water table is high or close to the ground surface, these contaminants will enter the ground water without filtration. If the water table is low, or far below the ground surface, the contaminants will become partially filtered by overlaying layers of soil before they enter the ground water.

2. *Concentration of contaminants.* A high concentration of contaminants will make ground water pollution more likely.

3. *Permeability of the geologic strata.* A high filtration occurs when the permeability of the geologic strata is high; see Table 1. High filtration speeds cause water contamination to pass rapidly into the ground water. If the permeability of the strata is low the contaminants will have more time to settle out and become filtered. See Table 1. The boundaries between strata, especially aquifers, vary in permeability. Thus contamination may leak downward from one aquifer to another. To prevent this in the Pinelands, the limit is one septic tank in three acres for the Protection Area, and one septic system in 39 acres in the Preservation Area.

4. *Thickness of the geological strata.* This factor affects water pollution the same way as does the depth of the water table. The more earth material the contaminants have to pass through before reaching the water table, the less likely the contamination of ground water.

5. *The toxicity of the contaminants.* A major contribution to ground water pollution today comes from leachates produced in sanitary landfills. Leachates are produced when water filters down through sanitary landfills and picks up dissolved materials from the decomposing solid waste. These materials include iron, sodium, potassium, calcium, magnesium, chloride, sulfate, carbon dioxide, nitrogen, organic material, and any other materials in the landfill.

Many chemical contaminants such as chloroform or carbon tetrachloride are not readily removed from the ground water by filtration. The more concentrated they are, the more toxic (poisonous) they are.

Factors that affect the composition of leachate from a landfill are:

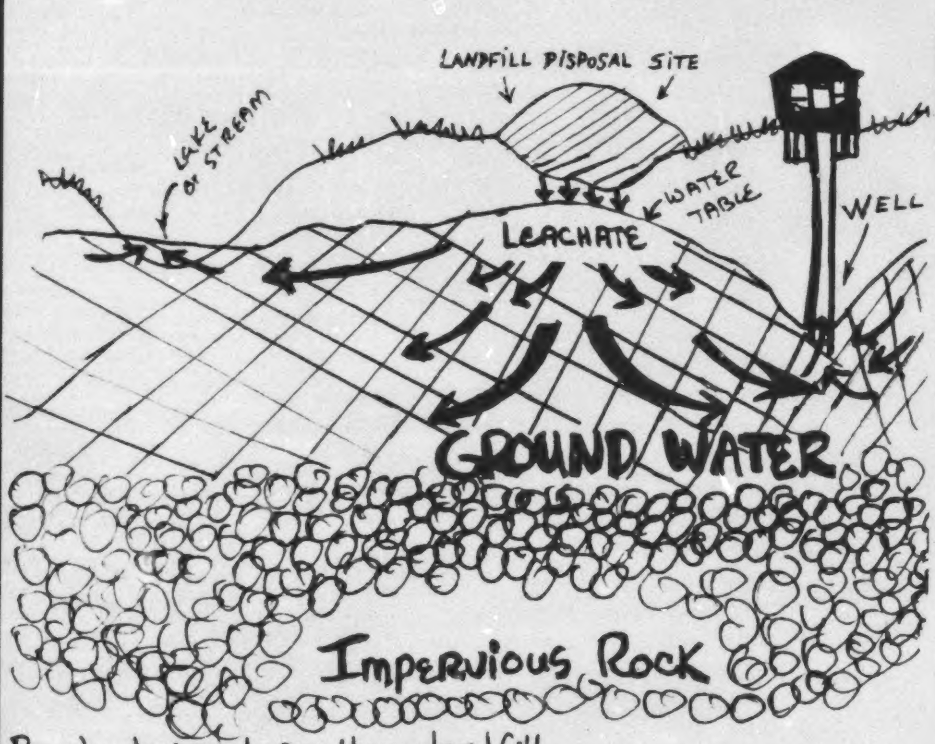
1. *Landfill material.* Is it biodegradable or non-biodegradable? Is it soluble or insoluble? Organic, or inorganic? Liquid or solid? Toxic or non-toxic?

2. *Landfill conditions.* The pH, temperature, degree of ongoing decomposition, moisture content, and landfill age, and climate.

3. *Characteristics of entering water.* The pH, temperature, and amount.

4. *Soil characteristics under landfill.* Permeability, depth or thickness of strata and mineral content.

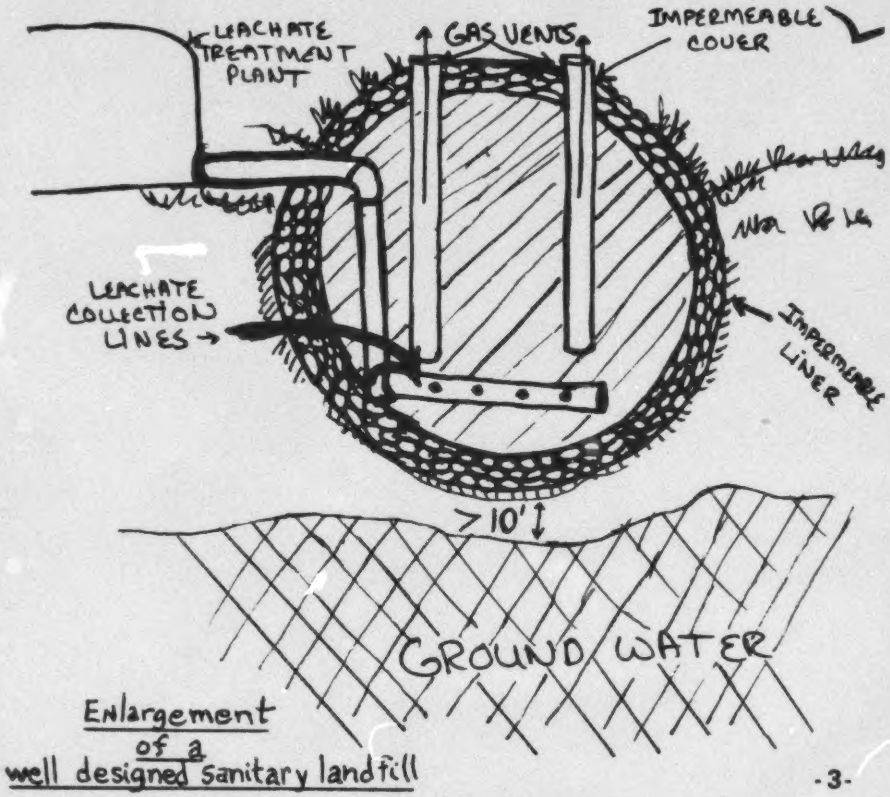
Below is a diagram of a possible ground water-landfill situation:


LANDFILL DISPOSAL SITE
LAKE OR STREAM
WATER TABLE
WELL
LEACHATE
GROUND WATER
Impervious Rock

Poorly designed sanitary landfill

Sanitary landfills today are constructed to prevent the production of leachates and/or prevent leachates from reaching the ground water. This is accomplished in a variety of ways. Water can be prevented from entering the landfill by diverting surface drainage away from it. Rainfall can be drained from the site by proper sloping of an impermeable surface layer. Barriers made out of clay or plastic may be constructed under the landfill to keep water from percolating down to the water table. Solid wastes are deposited at the landfill at least ten feet above the water table.

Below is a diagram of a properly constructed and contained sanitary landfill. Local conditions such as the previously mentioned factors must all be considered in the design of a particular landfill.


LEACHATE TREATMENT PLANT
GAS VENTS
IMPERMEABLE COVER
LEACHATE COLLECTION LINES →
IMPERMEABLE LINER
>10'
GROUND WATER

Enlargement of a well designed sanitary landfill

C LEACHATE ON THE ROCKS

YOUR JOB IS: REPORT ON THE GROUND WATER AND AQUIFER STATUS IN YOUR COMMUNITY.

Define the following terms:

aquifer
biodegradability
geologic stratification
ground water
permeability
pH
toxicity
water table

Your research may concentrate on any one or all of the following topics:

1. Study of the crucial aquifers in your area. Which aquifer supplies drinking water to your town? What is their estimated capacity (in billions of gallons per day)? What effects would the depletion of the aquifer have on vegetation? on land salability? on the quality of the water? quality of life?

2. Study the sanitary landfill in your community and its relation to the water table. What measures have been taken by your town to protect the ground water from pollution by the landfill? What are the dimensions of the landfill? What is the depth of the water table? What aquifers underlie the landfill region? Are they a source of water to your community? What types of testing and regulation are performed on the water quality near to your landfill? Are there any impermeable barriers between the landfill and underlying aquifers?

3. The composition, action and physical characteristics of leachate.

THE INFORMATION PROVIDED IN THIS LESSON IS ONLY AN INTRODUCTION TO THE RESEARCH YOU MUST PERFORM ON YOUR OWN. BELOW IS A LIST OF POSSIBLE SOURCES OF INFORMATION AND HELP FOR FURTHER STUDY.

To find out about your community's sanitary landfill, ground water supplies, local aquifers, wells and ground water quality contact:

- your county or township planning board for their master plan, natural resource inventory or soil survey.
- local environmental commission.
- health department
- state or county water quality official, for the "208" water quality regulation, water supply company, state geologist's office.
- most of the above places and agencies can provide you with various maps of your region.

To find out about sanitary landfills in general, along with production and water quality see the "Reader's Guide To Periodical Literature," in your library. This guide can provide you with up-to-date information on all of the above topics. Don't forget to ask your librarian for assistance.

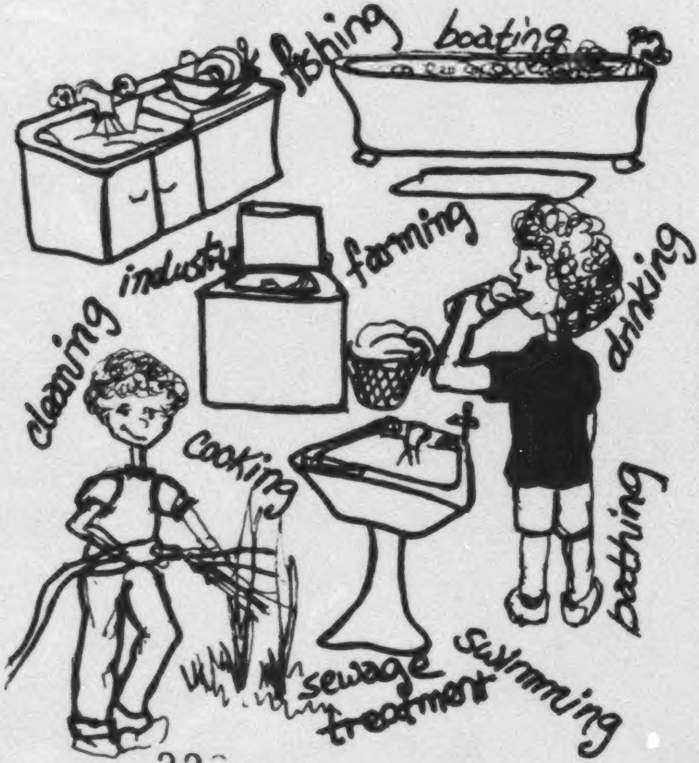
Prepare your research in the form of an oral report. If you are researching your local sanitary landfill, try to take pictures to document your study. Diagrams of geological strata will help illustrate local conditions.

CESC
CETA
10-12

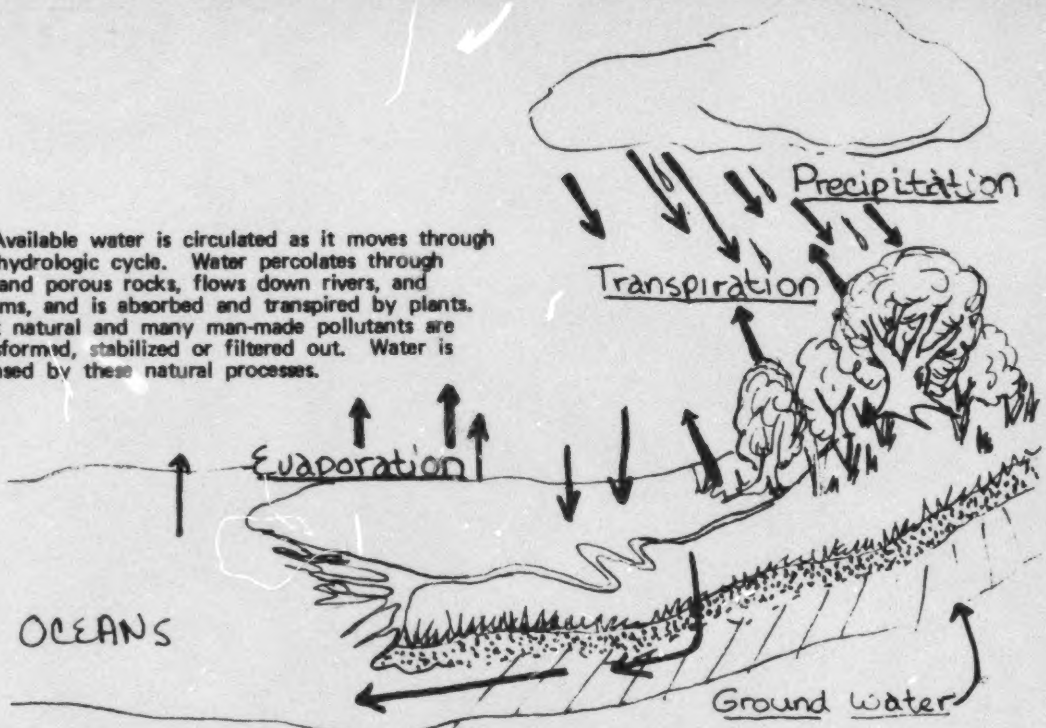
"Water, water everywhere, yet not a drop to drink!!"

A famous saying - we have all heard it at one time or another. Stop and think for a minute. What does that quote mean to you?

The earth's supply of water is vital to us. We must drink water to live. In addition, during a normal day's activity we use water for other numerous essential purposes, including cooking, bathing, cleaning and waste removal.



Available water is circulated as it moves through the hydrologic cycle. Water percolates through soil and porous rocks, flows down rivers, and streams, and is absorbed and transpired by plants. Most natural and many man-made pollutants are transformed, stabilized or filtered out. Water is cleansed by these natural processes.



In recent decades, increased technology and production, expanding population and more complex and extravagant lifestyles have severely interfered with the natural operation of the hydrologic cycle. The volumes and types of pollutants that find their way into waterways have seriously impaired water quality. Wastewater treatment facilities are designed to cleanse this "dirty water". Unless this "tainted water," is treated or cleansed, man may indeed find himself surrounded by water unfit for human consumption.

The objective of water pollution control is to minimize the harmful effects of water polluted by waste products from man's activities. It is one of the major environmental concerns of today. The objective of this lesson is to familiarize you with how wastewater is treated and to have you visit and observe the actual operation of a municipal wastewater treatment plant.

NOTE: Federal law mandates that the public be allowed to visit and view a municipal wastewater treatment plant if they so desire.

SEWAGE

After the water supply in a community has been impaired by various human uses, it is classified as sewage. Sewage is liquid or water wastes from residences, businesses, institutions and industries. It may contain excretal material, industrial wastes, garbage, paper, detergents, gas, oil, and a wide range of miscellaneous items such as dead animals, old shoes, and discarded clothing. In appearance it resembles used dishwater. It is often quite malodorous and may contain disease-producing bacteria. Generally, sewage consists of more than 99 percent water, .02 - .04% solid particles suspended in water, and the remainder, various dissolved chemical compounds. Although the percentage of suspended solids is small, their total accumulation represents an enormous volume of solid waste. The disposal of this waste is a serious problem. Solids in the sewage of a city the size of Washington, D. C. amounts to approximately 150 tons each day. The organic particles of protein, fats, and carbohydrates in these solids could not be broken down and digested naturally by microorganisms in waterways. The wastewater of Washington D. C. and many other communities is subjected to a series of processes designed to make it either fit for reuse, or less detrimental to receiving waterways.

These processes are mechanical, biological, or chemical. They are usually referred to as primary, secondary, and tertiary treatment stages. Each stage is designed to speed up the natural processes by which water is cleansed.

PRIMARY TREATMENT

Primary treatment of sewage involves removing varying amounts of inorganic material and 30-40% of organic material by mechanical means. Sewage entering the plant usually passes through trash racks. These consist of steel bars spaced 2-4 inches apart. They are designed to catch large debris. The sewage then passes through a series of screens which are graded from coarse to fine. This process removes coarse solids that have passed through the trash racks. The solid materials lodged on the screens are raked off and subsequently disposed of. Finding a suitable method of disposal for these solid wastes is often a burdensome task.

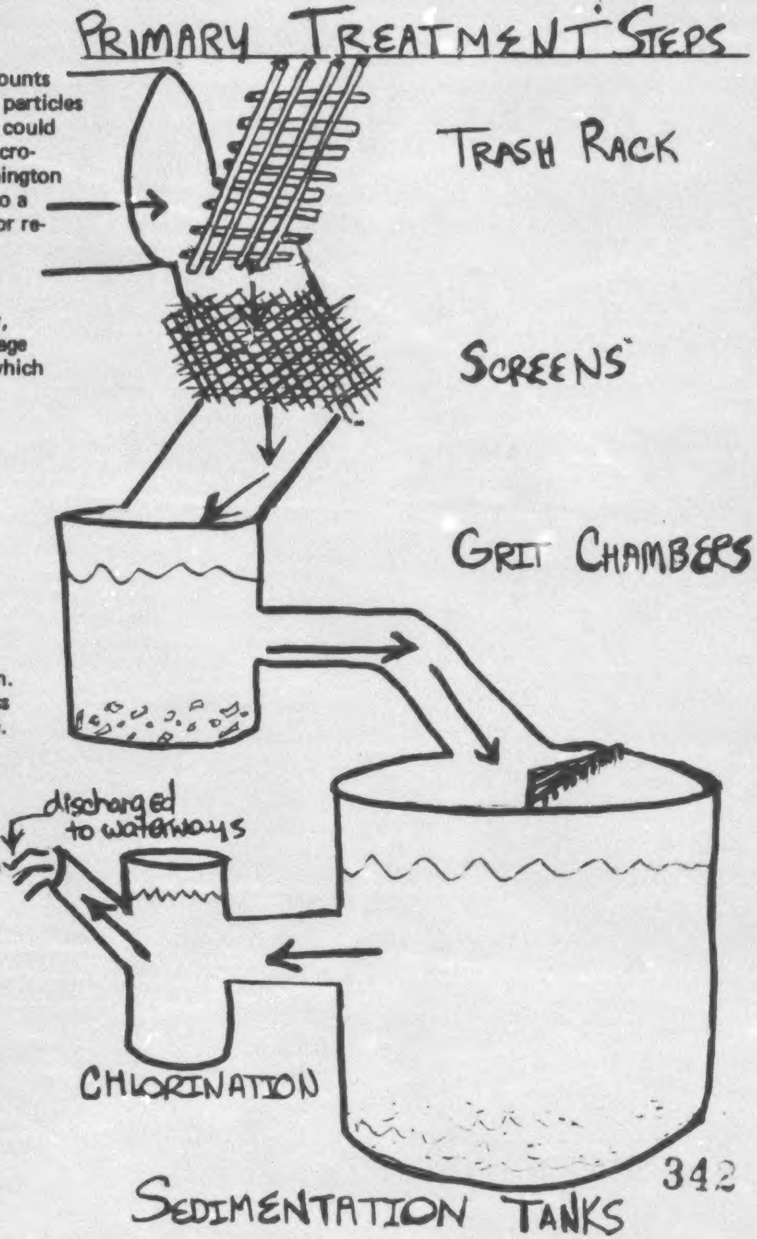
Some treatment plants use a device called a comminutor. This machine functions as both a screen and a cutter. It catches solid wastes and shreds them. The shredded material is removed during later steps. After screening, the wastewater passes through grit chambers. Sand, stones and other coarse mineral material are allowed to settle to the bottom and are later removed. This step is particularly important in communities with combined storm and sewer systems.

Next, the wastes are usually passed into skimming devices and settling tanks. The sewage is directed through one or more tanks and the speed of flow is sharply reduced. Many of the minute suspended particles of organic and inorganic matter gradually sink to the bottom. This process is known as sedimentation. The mass of remaining suspended solids is called raw sludge. It is composed of organic material and a wide range of bacteria and other microorganisms.

The disposal of raw sludge often constitutes a serious problem. The sludge is often dried and incinerated, brought to a landfill, or dumped into the ocean.

The final step in primary treatment involves chlorinating the effluent which leaves the sedimentation tanks. Chlorine gas is pumped into the wastewater to kill pathogenic bacteria and reduce odors. The effluent is then dumped into receiving waterways.

Primary treatment is inadequate for the needs of today's cities and industries because it only partially removes the suspended and dissolved solids. Furthermore, today's regulations require additional treatment before sewage effluent can be dumped into waterways.



(Supplement to be used with High School lesson *D Visiting a Wastewater Treatment Plant.*)

Below is a list of questions to ask your guide during your visit. Add more if you can think of any others.

1. Does the community have a combined sewer system? If so, what kind of problem does this pose?
2. What is the daily volume of wastewater treated? What is the plant capacity? How do the two compare? How much growth can the community support?
3. Have there ever been any accidental spills or overflows? If so, why? What were the environmental impacts?
4. Is tertiary treatment employed? What pollutants are removed?
5. What are indicator organisms?
6. What does a fecal coliform bacteria count show?
7. What are the federal requirements for coliform bacteria levels? For primary nutrients (nitrogen, phospherous)? How are these levels decided upon and established?
8. What did it cost to build this facility? How much does it cost to operate and maintain it? Where does the money come from?
9. How do other countries treat their sewage?
10. How is the sludge disposed of? Does it have any practical uses?
11. What is the percentage of water quality purity after each of the treatment processes?
12. Do many sewage treatment plants provide tertiary treatment? Why or why not?
13. What are the criteria for the primary, secondary and tertiary stages pf treatment? What is the purpose or final outcome of each stage?
14. What types of tests are performed in the laboratory?
15. Does the wastewater change color as it passes from one stage to another?
16. During secondary treatment the sewage is aerated. Does airborne bacteria from this process pose a hazard to workers at the plant?
17. What are sewage outfall pipes?

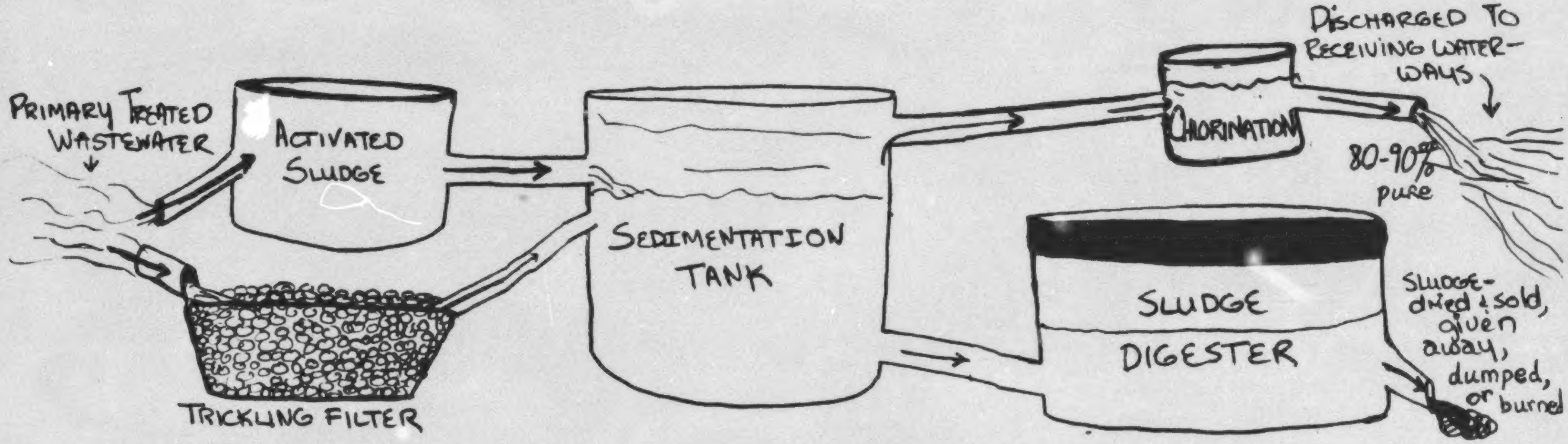
WORKSHEET

Define the following terms:

1. Activated carbon ________________________________
2. Activated sludge ________________________________
3. Aerobic ______________________________________
4. Anaerobic _____________________________________
5. Chlorine ______________________________________
6. Coliform bacteria _______________________________
7. Dissolved oxygen ________________________________
8. Effluent ______________________________________
9. Hydrologic cycle ________________________________
10. Indicator organisms _____________________________
11. Inorganic _____________________________________
12. Land farming __________________________________
13. Methane gas ___________________________________
14. Organic ______________________________________
15. Primary treatment _______________________________
16. Secondary treatment _____________________________
17. Tertiary treatment ______________________________
18. Sedimentation _________________________________
19. Sludge _______________________________________

SECONDARY TREATMENT

Secondary treatment involves removing most of the colloidal and organic matter present in sewage. As much as 90% of the organic matter is removed. The two principal types of secondary treatment use devices called trickling filters and activated sludge tanks. After the sewage effluent leaves the grit screens and sedimentation basins employed in primary treatment, it flows to a facility where one of the previously mentioned methods is employed to treat it further.


PRIMARY TREATED WASTEWATER
ACTIVATED SLUDGE
TRICKLING FILTER
SEDIMENTATION TANK
CHLORINATION
DISCHARGED TO RECEIVING WATER-WAYS
80-90% pure
SLUDGE DIGESTER
sludge-dried & sold, given away, dumped, or burned

TRICKLING FILTER

A trickling filter is simply a bed of stones, 3 - 10 feet deep, through which primary treated sewage is allowed to pass. Bacteria and other microorganisms gather and multiply on these stones. They cover each stone with a gelantinous coat known as "zoogleal film". These microorganisms serve important functions. Sewage is passed over the stones by a rotating sprinkler or a series of pipes. The bacteria consume most of the organic matter in the sewage as it flows over the stones. Multiple filters may be utilized depending upon the size of the plant and the volume of wastewater.

ACTIVATED SLUDGE

In the activated sludge process, sewage is kept in huge basins for several hours. Here it is mixed (agitated by violent stirring) with sludge.loaded with bacteria and air. The bacteria decompose most of the organic matter under these aerobic conditions. Thus, bacteria require dissolved oxygen in the wastewater. The sewage leaves this tank and flows into another sedimentation basin. This stage completes the aerobic stage of secondary treatment. The activated sludge is composed of sludge taken from the sedimentation tank.

SLUDGE DIGESTION

In secondary treatment, the sludge or solid material which has been removed from the wastewater is decomposed by bacteria under anaerobic conditions. Decomposition occurs within a closed, airtight container called a sludge digester. These anaerobic bacteria utilize oxygen released from their own digestive enzymes or the nutrient materials in the sludge. The sludge in the digester is decomposed or reduced to methane gas (swamp gas) and water. Often the methane gas may be used to heat and power the building. The methane gas may also help to maintain an optimum temperature for decomposition in the digester tanks during the winter.
The sludge is often difficult to dispose of. It is usually dumped in the ocean, burned, or land farmed.

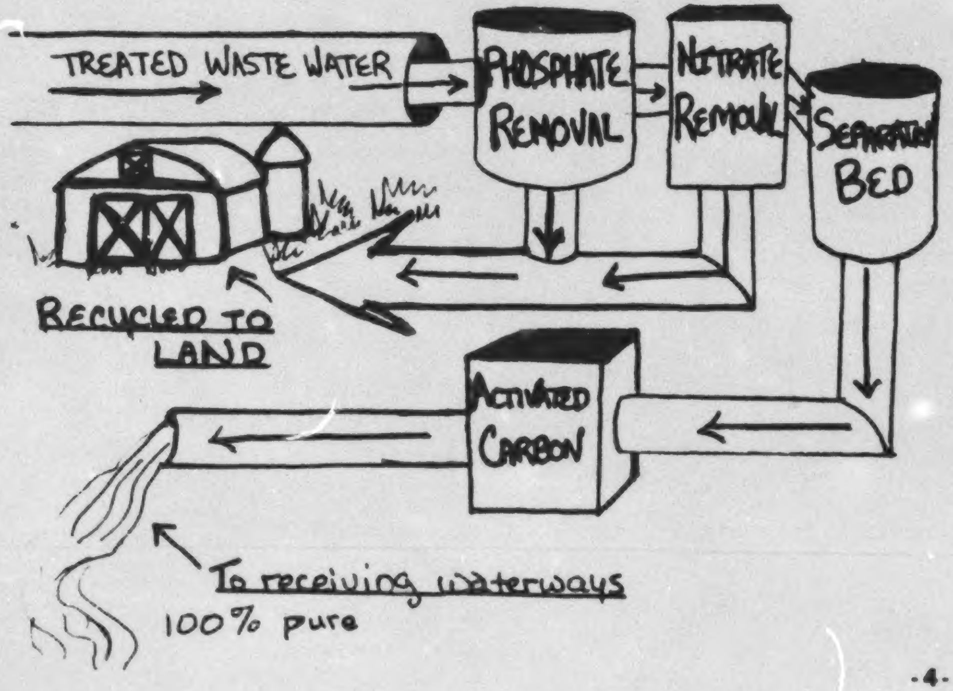
CHLORINATION

Chlorination completes basic secondary treatment. Following chlorination the effluent is ready to be discharged into a receiving water body. If the effluent still contains significant quantities of dissolved solids, then aerobic decomposition will occur in the stream itself. This decomposition consumes dissolved oxygen. If the concentration of dissolved oxygen becomes low, the lives of fish and other aquatic animals could be threatened.

TERTIARY TREATMENT

Tertiary treatment further improves the quality of wastewater by removing or reducing the concentrations of harmful and undesirable chemical constituents. Secondary treatment is simply a refinement of primary treatment. Both remove decomposable materials from wastewater. Tertiary treatment employs a variety of chemical and physical processes in an attempt to bring the effluent to a high level of quality. If all sewage treatment facilities provided effective tertiary treatment, the problem of returning used water in a clean condition would almost be eliminated.

A tertiary treatment system is difficult to operate because polluting chemical substances often change in content and concentration as new wastes are added or as old industrial processes change. Some of the chemicals which may be removed or reduced in tertiary treatment are toxic substances such as oil, lead, nitrate, phosphate, methyl, acids and cyanide. The following diagram illustrates a tertiary system which removes the previously mentioned toxic stustances.



YOUR JOB IS: VISIT A LOCAL SEWAGE TREATMENT PLANT

BEFORE YOU GO

A. Research one or more of the following topics:
  1. environmental impact of sewage effluent and sludge.
  2. environmental laws relating to sewage and wastewater.
  3. biological aspects of secondary treatment.
  4. tertiary treatment types.
  5. economical aspects of building, operating and maintaining a municipal wastewater treatment plant.
  6. combined sewer and stormwater systems.
  7. physical, chemical and biological characteristics of sewage.

B. Conduct class discussions on each topic for a few days before your trip.

C. Study the three basic treatment processes described here and know the steps involved in each one. Be able to distinguish between them.

D. Define and discuss the terms listed on the enclosed worksheet.

DURING YOUR VISIT

A. Use the enclosed worksheet to record answers to the questions you ask your guide

B. Take pictures if allowed to help document a possible class presentation.

UPON YOUR RETURN

A. Write a thank you note (as a class) to your guide at the plant.

B. Divide up into groups. Each group should organize the information gathered during the field trip. Prepare a 15-20 minute presentation to describe the operation of the wastewater treatment plant. Each group may emphasize a different aspect of the operation if desired. Use drawings, graphs and charts to supplement the presentations.

C. Research wastewater treatment operations of other countries. What differences can you find in treatment and in the use of water?

D. What is a septic tank? How does it work?

E. Possibilities for other field trips: 1) Chemical Plants 2) Paper Recycling Plants 3) Glass Recycling Plants

F. Economics of wastewater treatment plants.

G. Alternatives to wastewater treatment plants i.e. waterless toilets.

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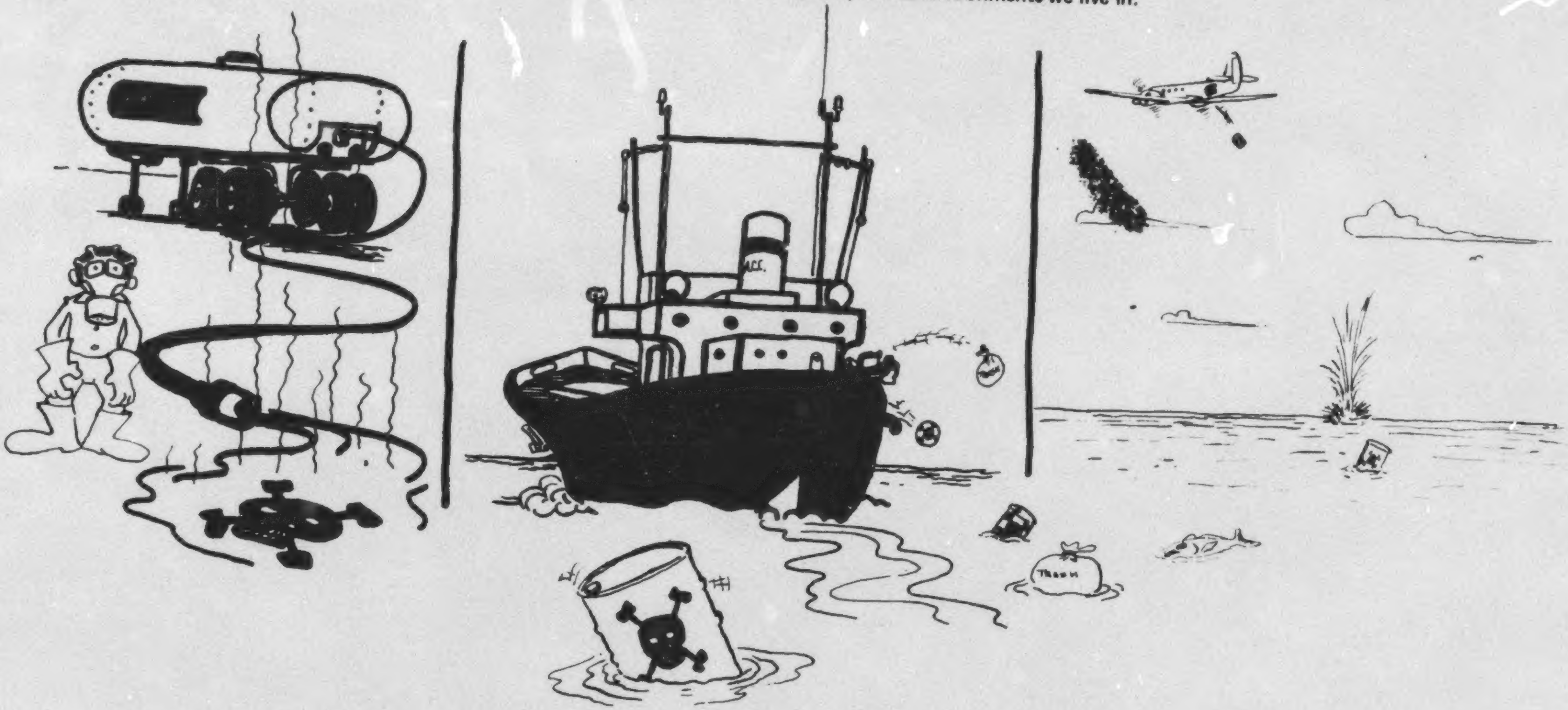
THE ANSWERS WE'VE FOUND...ARE PROVING UN-SOUND

For centuries western culture has envisioned the earth as a place of unlimited frontiers and resources, where increasing comsumption and production inevitably led to a better life. When people polluted or destroyed one area they merely moved on to another unspoiled area. Even the last remaining frontiers of Antarctica and the Arctic Circle contain traces of pollutants from our modern wasteful society. With the remaining unspoiled frontiers on the verge of disappearing, we must make plans to restore and maintain the quality of the environments we live in.

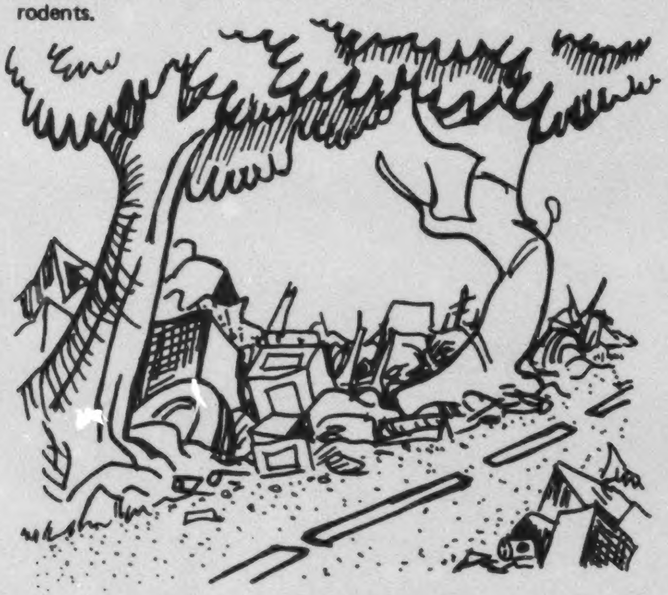


The history of the disposal of solid wastes has shown that people have discarded their solid wastes close to their homes or communities. Buildings and entire cities have risen atop the wastes and ruins of a bygone time in society. (See grade 7-9 activity card A-1). Until the last few decades, this method seemed to work well enough. But now each member of our rapidly growing population produces more solid wastes each year. Old ways are clearly no longer feasible; solid wastes disposal is a multi-faceted problem.

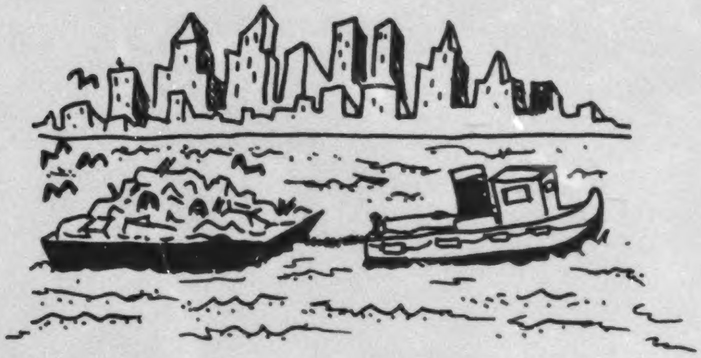
YOUR JOB IS: To present the "Wasteful Distasteful Disposal Award" to the company/companies, organization/organizations, or government agencies your class feels are most damaging the environment by their current solid wastes disposal methods.

Read About, Then Research the Following Solid Waste Disposal Methods:

OPEN DUMPING – This type of waste disposal is currently illegal. Many people disregard the current regulations, evident by the many piles of trash that litter our forest and country side. Open dumping can cause pollution of our land, air, water, pose fire hazards, create unsightly nuisances and breed germs, insects and disease carrying rodents.

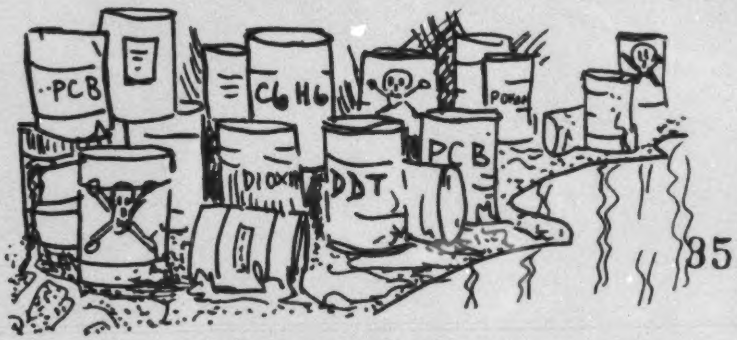


DUMPING DREDGE SPOILS – Out of sight...out of mind. Almost all of our nations principal waterway's are presently polluted. The Hudson, the Delaware, the Mississippi, the Ohio, etc. This pollution is partly attributed to silt erosion. This silt runoff causes plant and fish life to die, it clogs our shipping lanes and contaminates our water due to herbicides and pesticides entering the water along with the silt runoff. Proposed answers to the problems of silt are to dredge the silt and dump it further out into the ocean. Out of sight...

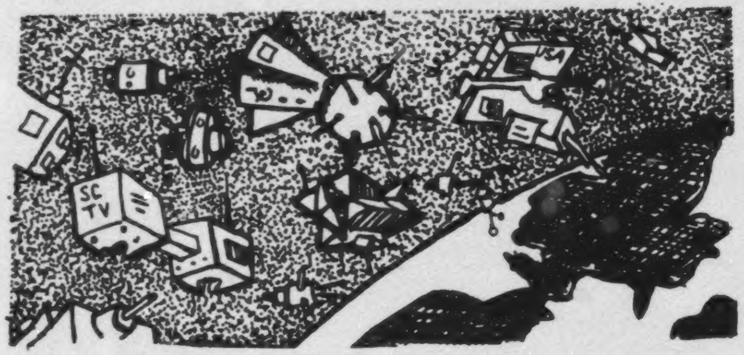


HAZARDOUS AND TOXIC WASTE DUMPING – Technology applied to better human lives now threatens to destroy the earth.

Everyday it seems another harmful chemical is being found in the water we drink, the food we eat and the very air we breathe. Fish and other aquatic forms are dying, animal habitats are disappearing. Workers are getting cancer from the materials they manufacture. In past years it was accepted practice to dump or store hazardous/toxic waste in the earth. We are now realizing the effects on human health that dumping these wastes have brought about. Today there are environmentally sound techniques available to dispose of hazardous/toxic waste. Due to astronomical expense for this process many hazardous/toxic waste generators dispose of their waste illegally when and where they can, at the expense of the people who live near these illegal dumpsites, both in health and money.

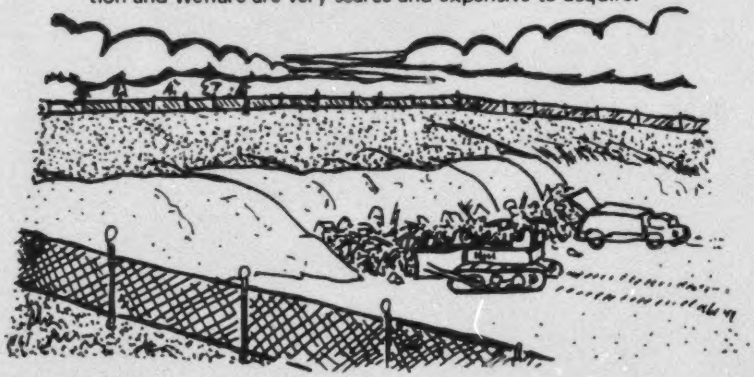


SPACE WASTE – Most Americans have thrilled at the progress of the space age and the pioneering of the aerospace programs of the United States. But while we were basking in the sunshine of our own pride, we may have failed to notice the space refuse which has been left in the wake of space vehicles and lunar or planetary visits. Find out what happens to the parts of jet and rocket engines when they are jettisoned in interplanetary space. Should we have left all those vehicles and other items on the moon? Find out how we have changed the moonscape by writing to the Federal Aerospace Administration. Will space junk be out there forever? Consider these items and strive to get an accurate report.



SANITARY LANDFILLING – The best we can come up with.

Today's most acceptable solid wastes disposal method. If the sanitary landfill is not properly operated the same problems listed under open dumping can occur. Considering the huge bulk of solid wastes disposed of in sanitary landfills, a large waste of reclaimable natural resources occurs. Also, land suited for construction of new sanitary landfills following regulations enacted by the Department of Health, Education and Welfare are very scarce and expensive to acquire.



Where to Look for Information:

1. - school or public library (periodicals, books and newspapers)
   - County Board of Health or Solid Waste Administration
   - state or county water quality officials
   - Federal Environmental Protection Agency (pamphlets and brochures)
   - local planning boards and environmental commissions
   - industries, factories and companies in your region
2. You may wish to check out books from your school or public library on solid waste disposal methods. This will help give you a better understanding of the problems we face today.
3. You may wish to examine the newspaper morgue located at your public library or local newspapers concerning solid wastes disposal.
4. It may be helpful to start your own newspaper file in your class. All class members who receive newspapers should cut out any articles on solid waste disposal. Bring them into class. Keep articles separate according to type of disposal methods. These articles may help you decide who should receive your "Wasteful Distasteful Disposal Award".
5. Many organizations publish pamphlets and newsletters that may be helpful during your research. If you wish to acquire these pamphlets, contact the County Health Department or a health department in your town. They should be able to provide addresses for you to send away and request the pamphlets and newsletters.

THE DISPOSAL AWARD

E

Choosing the Recipient:

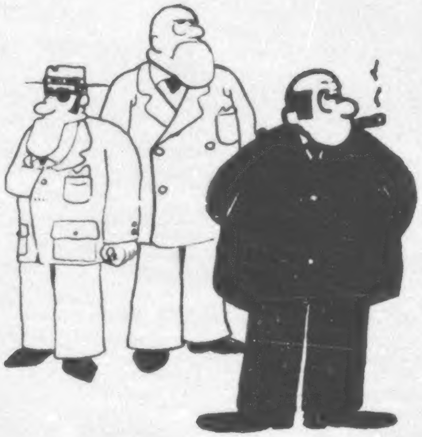
1. - Once your class has a good understanding of the environmental damages that occur with current solid wastes disposal methods, decide which company/companies, organization/organizations or governmental agencies do the most damage to the environment by their solid waste disposal methods.

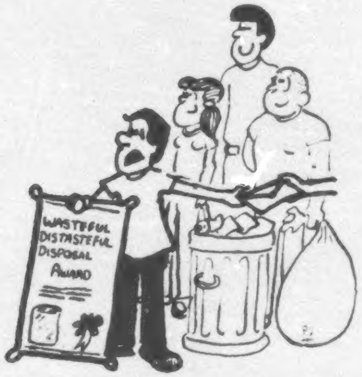
2. - As a class you may wish to design a form of the award you intend to present. You may have a contest among class members to rename the award if you wish to change it.

3. - Your newspaper files, newscast on television, pamphlets you've received and any public hearings you may have attended will help your class decide to whom to present your award.

4. - Try to interview officials of companies (if they are close enough) your class is considering presenting the award to. Get their views on solid waste disposal and what they intend on doing about polluting the environment.

5. - Try to interview state or governmental officials or organizations that have different views than the officials who represented the company your class intends on presenting the award to.





Presenting Your Award:

1. - Your class will probably have a long list of possible recipients for your award. As a class decide which organizations or companies should receive the award.

2. - Once your class has decided on recipients, you are ready to present your award.

   Get as much publicity as you can for your awards presentation. Your school newspaper, local radio station, or a nearby television station should be contacted concerning your awards presentation. If the recipient is a long distance away, 1st class registered mail will be your best bet of making sure the recipient receives the award.

3. - You may ask the recipients of your award to comment to your class in person or by mail their feelings on receiving your "Wasteful Distasteful Disposal Award", and what, if anything they intend on doing about the problem.

   In all fairness your recipients may have very good reasons for using the harmful disposal methods they are using. Their explanation may help you to understand the problems they face.

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10-12

CAN YOU DO THIS ?

Many new technological advances have been made as the problems of solid waste disposal have impacted our society. The feared effects of ocean sludge dumping have been brought under some control. Recycling of glass, paper, metals and even plastics is going on in many states, New Jersey among them. There are many instances of progress already made in meeting the solid waste dilemma--if progress is considered to be an improvement in conserving space, energy, materials and resources.

After reading about and researching solid waste disposal methods that are environmentally damaging, you may wish to develop and present a "Good Guy Disposal Award". While searching for Good Guy recipients, follow this lesson outline.

WHAT'S THE TROUBLE ?

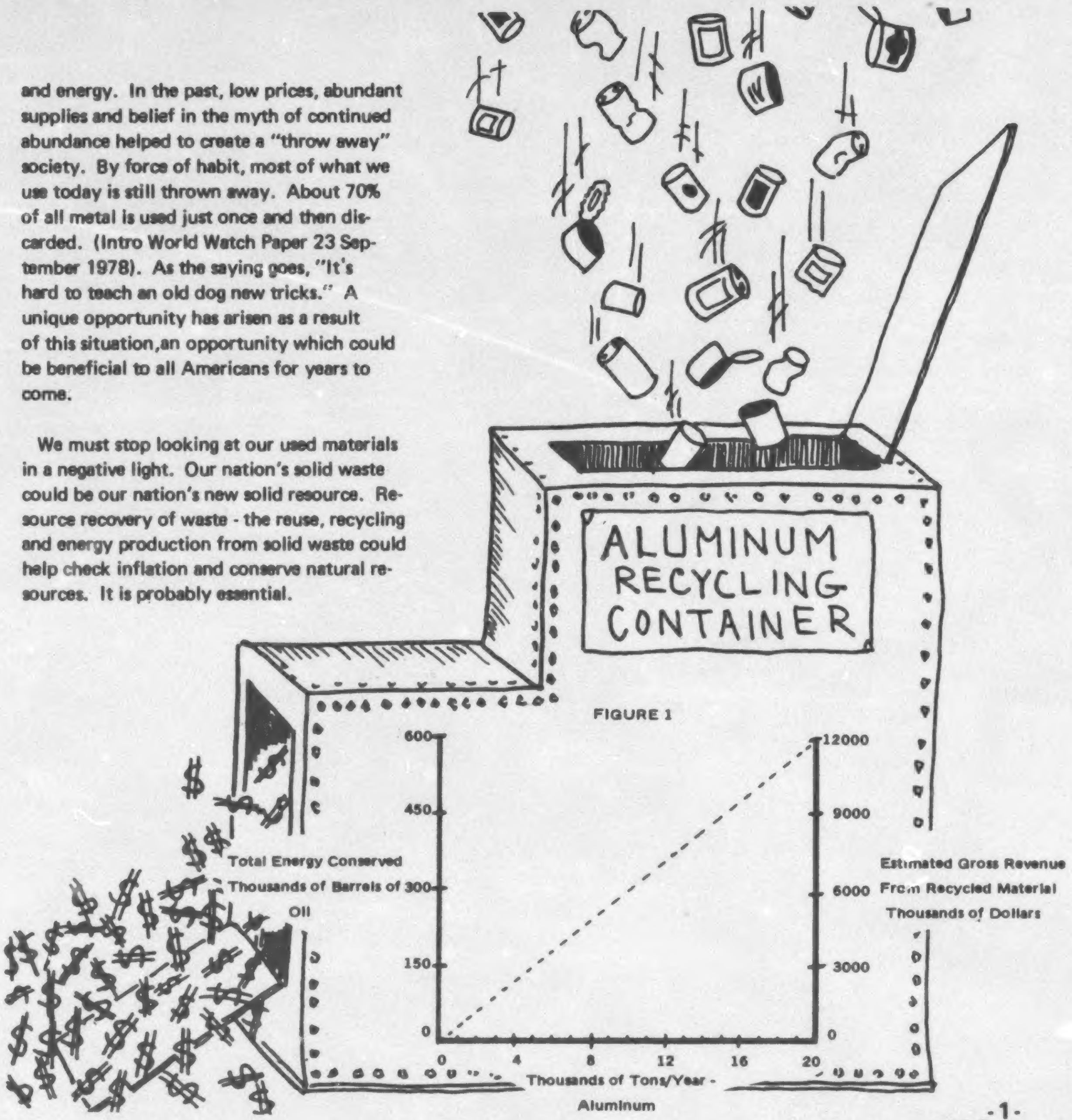
Many of the world's nonrenewable energy resources and raw materials (coal, oil, etc.) are quickly being used up. In addition, political, economic and environmental constraints and distribution further limit supply. For example, the United States and most of the industrial countries of the world have a great dependency on imported oil. The fact is: The world has been facing an ENERGY CRISIS for a decade. Energy shortages are causing hardship or at least inconvenience for millions of people. Because the energy shortage has an impact on the daily lives of us all, we have come to realize that many of our physical resources are in limited supply. The present age of shortages means that there is also a RAW MATERIALS CRISIS. It is essential that people become more aware of the great need to conserve and reuse every available resource.

Awareness alone, however, will not solve the problem. It is necessary to carry our awareness one step further and put these concepts into practice. The task is not a simple one. Improved technology and increased population have resulted in an enormous increase in the consumption of raw materials and energy. In the past, low prices, abundant supplies and belief in the myth of continued abundance helped to create a "throw away" society. By force of habit, most of what we use today is still thrown away. About 70% of all metal is used just once and then discarded. (Intro World Watch Paper 23 September 1978). As the saying goes, "It's hard to teach an old dog new tricks." A unique opportunity has arisen as a result of this situation, an opportunity which could be beneficial to all Americans for years to come.

We must stop looking at our used materials in a negative light. Our nation's solid waste could be our nation's new solid resource. Resource recovery of waste - the reuse, recycling and energy production from solid waste could help check inflation and conserve natural resources. It is probably essential.

REWARDS FOR RECYCLING

FIGURE 1



WHAT DO YOU THINK?

Try out these true/false questions:

T F Resource recovery of solid waste will eliminate all of America's energy and raw material shortages.

T F Over one half of the metal used in this country is thrown away after being used once.

T F The availability of resources in a country may be affected (influenced) by its political relationships with other nations.

T F Public awareness alone of the energy resource and raw material availability problem will solve the problem.

T F Our "throw away" society evolved in part due to low prices and abundant supplies in the past, improved technology, and increased population.

The price of fossil fuels is influenced by many factors. Oil costs cannot be blamed solely on OPEC regulation and escalation. Multinational oil/energy companies are slow to develop new alternative energy methods and supplies even when they know that nonrenewable fossil fuels will soon be depleted. Why? Maybe because it is not always economically beneficial to the oil producers. What about political decision making? Why doesn't the U.S. government devote more effort toward finding suitable alternatives? Clearly, many factors contribute to the complex problem we face today. No simple solutions exist, yet the problem should not be insurmountable. Certainly the economical feasibility of alternative energy sources will increase as supplies of nonrenewable fossil fuels continue to dwindle.

More than 1/5 of the total United States energy budget is now spent on producing material goods; and that fraction is rising (p.16 World Watch Paper No. 23, September 1978). Escalating energy prices, raw material shortages and other constraints are making it increasingly expensive and difficult to maintain production levels (p.6 Recycling in the 1980's, September 1980).

"In 1973, the average annual price of a barrel of crude oil was $5.50. In 1980, this price rose to $34.63 per barrel...The Energy Economic Group of the Chase Manhattan Bank has projected the price per barrel to be $57.05 in 1985."

Our society's reliance and dependence on fossil fuels, concurrent with limited energy supplies has helped to bring about this inflationary period. The situation, along with political decisions may force us to alter our life styles now and in the future.

8% of the total energy consumed in America is used in the primary metals industry. About 2/3 of this is used for iron and steel production and about 1/5 for aluminum (p.16, World Watch Paper 23, September 1978). The ever expanding plastics industry uses oil as a main ingredient for its products. "In the United States, more energy is embodied in plastics manufacture than is used in aluminum production." (p.16, WWP 23, September 1978). The potential energy "invested" in plastics is generally only recoverable through combustion.

In certain situations, the amount of energy required to develop a product from virgin resources is greater than if the same product were produced from recycled materials. The recycling (one form of resource recovery) of aluminum, copper and polyethylene plastics can save and recover large amounts of energy. Recycling of newsprint, glass, and steel also saves energy, though not as much as from the previously mentioned items.

CAN YOU ANSWER THESE?

1. What was the percent increase for the average annual price of a barral of crude oil from 1973 to 1980?

2. The Energy Economic Group of the Chase Manhattan Bank has projected that the price per barrel of crude oil is 1990 will be 194% greater than the 1980 price. What is the projected price?

YOUR FIRST JOB is to study Table 1 and complete the questions.

Table 1 illustrates and compares energy used in processing virgin materials and recycled materials.

Table 1: Energy Used in Processing Virgin and Recycled Materials

Material	Energy Needed to Process Virgin Ore	 Recycled Material	Amount of Energy Saved by Recycling
	(BTU/pound)*		(percent)
Steel	8,300	7,500 (40% scrap)	10
		4,400 (100% scrap)	47
Aluminum	134,700	5,000	96
Aluminum Ingot	108,000	2,200-3,400	97
Copper	25,900	1,400-2,900	88
Glass Containers	7,800	7,200	8
Plastics (polyethylene)	49,500	1,350	97
Newsprint	11,400	8,800	23

* *British Thermal Unit - A measure of the quantity of heat needed to raise the temperature of one pound of water 1° F. One barrel of oil is the equivalent of 42 U.S. gallons and contains 5.5×10^6 BTU.*

Source: Adapted from Christopher Hill and Charles Overby.

(Pg. 17 World Watch Paper 23 1978)

After studying Table 1, use the table to answer the following questions.

A) What is the percent of energy saved by processing one pound of recycled plastics versus using virgin materials?

B) 8,800 BTU are needed to process one pound of recycled newsprint. This quantity of energy is 23% less than the amount needed to process newsprint using virgin materials. How many BTU's are needed to process one pound of newsprint using virgin resources?

C) 134,700 BTU are required to process one pound of aluminum using virgin ore. 96% of this energy is saved by using recycled aluminum. How many BTU's are needed to process one pound of recycled material?

D) One barrel of oil contains 5.5×10^6 BTU's. How many tons of steel can be processed with 1 barrel of oil using virgin ore? Using 40% scrap? 100% scrap?

E) N.J. produced 258,000 tons of ferrous cans in 1980. Of this total, the current potential available for recycling is 127,000 tons (p.11, Recycling in the 1980's - State of New Jersey, Office of Recycling). How many BTU's would be saved if all of the potential reusable steel was recycled? How many barrels of oil would be conserved? Using the current price of a barrel of oil, how much money would be saved?

We saw in the previous section that by recovering certain resources through recycling, much energy and money can be saved. How much reusable material is available for recovery? Let's look at the situation in New Jersey. The State of New Jersey Office of Recycling estimated that in 1980, the level of recycling of aluminum, ferrous cans, glass and paper was about 0.5 million tons per year for the state. They claim that the potential level is 1.3 million tons. Vast amounts of energy could be conserved if the potential level of recycling was reached through increased recovery. Your job is to find out how much energy can be conserved and what the estimated gross revenue from recycled materials would be in New Jersey if the potential level of recycling is reached. To do this you must study Figures found on pages 1-4. Using information from these graphs complete Table 2.

TABLE 2

Energy Conservation in the Manufacturing Process
Through Increased Materials Recovery (for New Jersey)

Recoverable Material	Thousands of Tons/Year	Energy Conserved Barrels of Oil per ton of material	Total Energy Conserved, Thousands of Barrels of Oil	Gross Revenue per Thousand Tons	Gross Revenue Millions of Dollars
Aluminum	19				
Ferrous Cans	89				
Glass	305				
Paper	460				
TOTAL	873				

RESOURCE RECOVERY

F

Figure 2

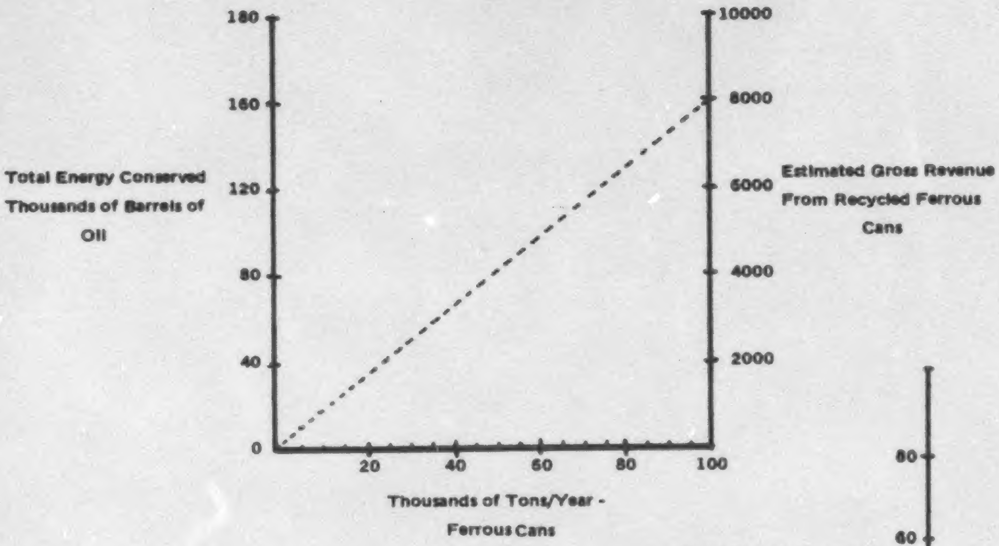


Figure 3

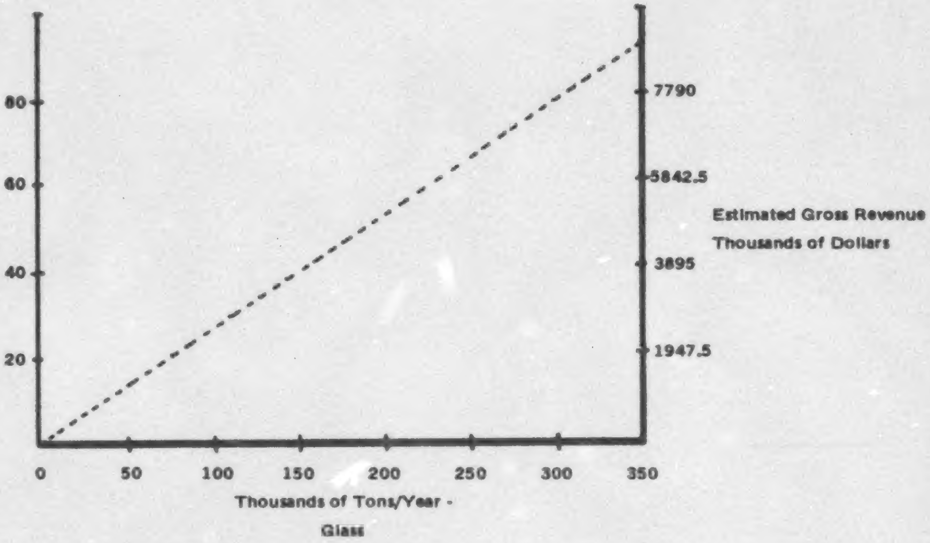
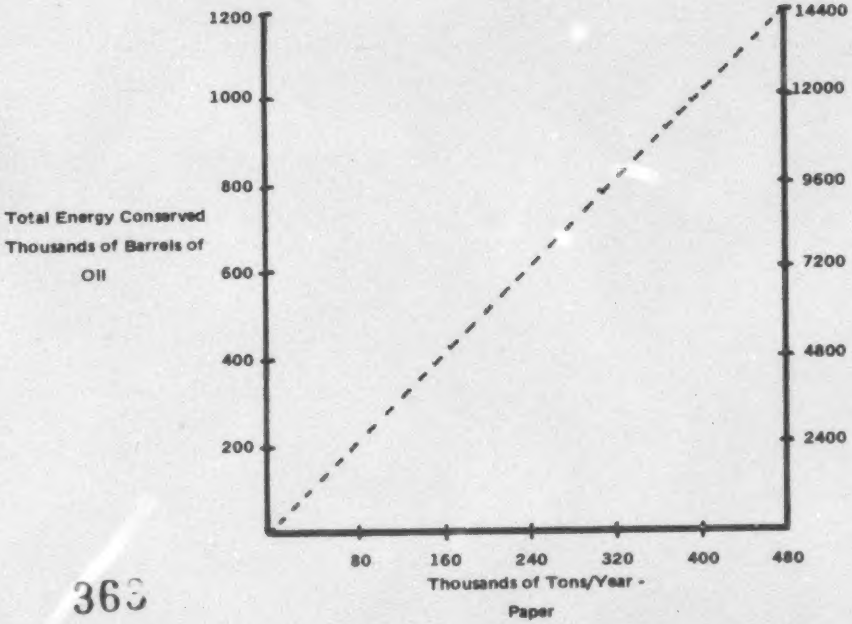


Figure 4

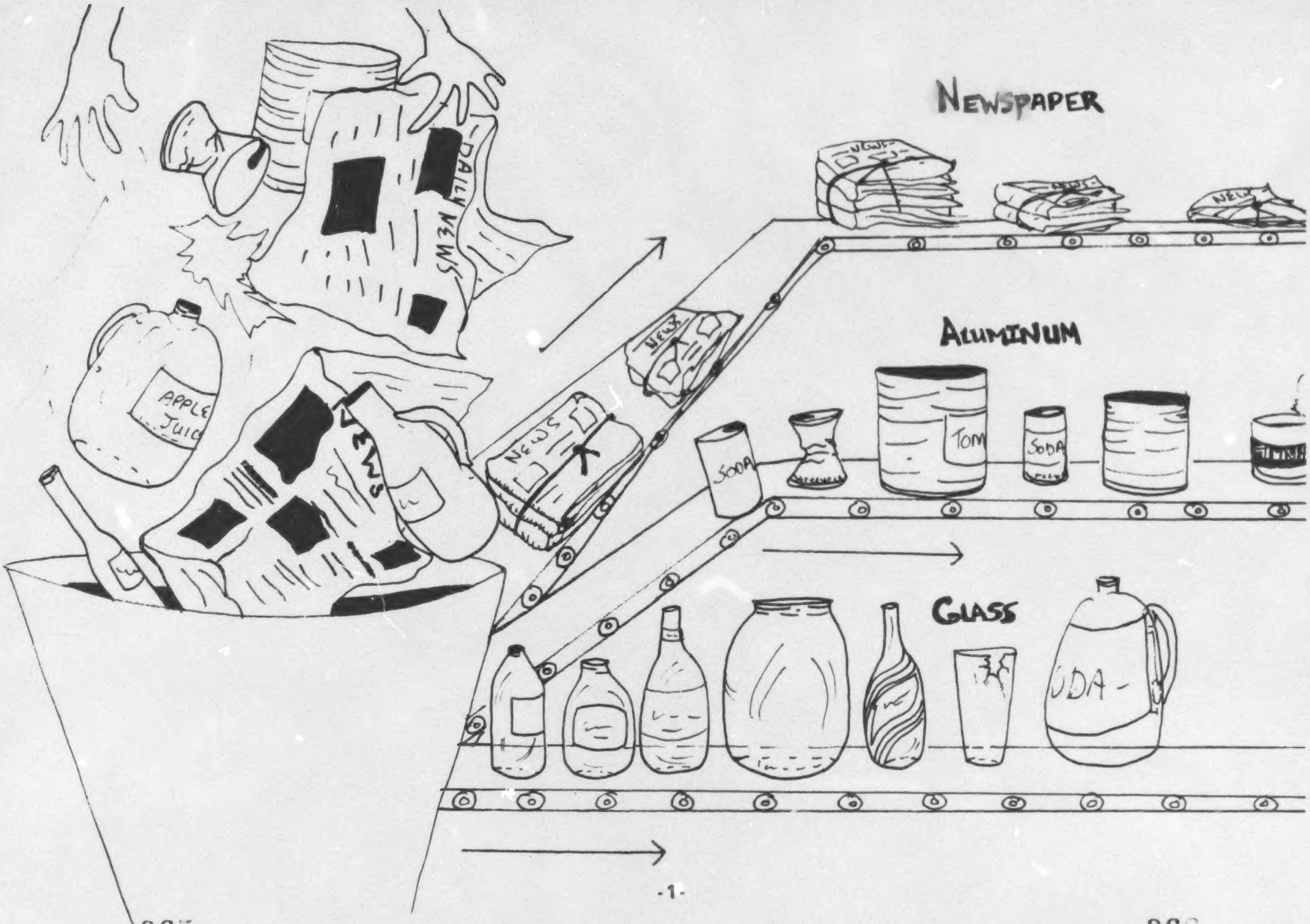


MORE -

The resource recovery of solid waste has many positive impacts on our society. It helps check inflation, conserve natural resources, saves money, provides jobs and reduces our dependence on foreign supplies of oil. Two other types of resource recovery are the energy production from the pyrolysis of solid waste and the reuse of discarded materials.

Do some library research to make an economic "case" for the value of pyrolysis. Get information from:

National Center Resource Recovery
1211 Connecticut Ave. N.W.
Washington, D.C. 20036


NEWSPAPER
DAILY NEWS
NEWS
NEWS
NEWS
NEWS
ALUMINUM
APPLE JUICE
SODA
TOM
SODA
GLASS
SODA

WHAT DO YOUR NEIGHBORS REALLY THINK ABOUT SOURCE SEPARATION?

The amount of municipal solid waste generated in New Jersey each day is of sufficient volume to fill Giant Stadium every two weeks.

As solid waste management problems become increasingly evident, methods have been sought to encourage people to take a new look at "garbage". Planners have sought to develop measures that would both lower the volume of wastes going to landfills, as well as put particular waste materials to use. The recycling of materials such as newspapers, glass and metal performs both of these functions.

Under New Jersey Public Law 1975, Chapter 326, entitled the New Jersey Solid Waste Management Act, each county and Hackensack Meadowlands Development Commission were designated as solid waste management districts. Under the provisions of the Act, each district is responsible for developing and implementing plans which provide for the "maximum practicable use of resource recovery strategies" (i.e. recycling).

The Burlington County Office of Waste Management Programs, situated within the County Health Department, has developed an implementation plan for a two-year pilot program in the curbside collection of source separated newspaper. Source separation programs are a major component of the overall resource recovery strategy identified in the Burlington County District Solid Waste Management Plan, adopted by the Board of Chosen Freeholders. The source separation plan sets forth a comprehensive program whereby a private contractor will provide curbside collection of used newspaper on a bi-weekly basis. The contractor is not paid by the participating townships of the County for this service, but instead is expected to offset his operating costs and realize a profit through the sale of the newspapers.

Scout troops, charitable organizations and individual scavengers will be able to continue their operations with minor changes in their present collection methods. In fact, recent studies indicate that such groups thrive when co-existing with a formalized municipal program.

The source separation program is designed to be self-supporting (not requiring a subsidy through the uses of tax-payers money). It will provide a savings to each township. This savings can appear as: 1) a rebate from the newspaper collector based on tonnage of newspaper recovered, 2) a rebate from the mixed refuse collection in townships with contracted garbage collection systems. Townships with their own regular garbage collection systems may save money by decreasing the volume of waste to be collected, 3) a rebate from savings encountered by re-routing regular garbage collection vehicles in a more energy efficient manner, 4) reduced disposal costs due to less material to be landfilled, 5) conservation of scarce and costly landfill capacity. With each ton of newspaper recycled, three cubic yards of landfill space and seventeen trees from valuable forest lands are conserved. In addition, 60% to 70% less energy is utilized in producing new pulp products from recycled paper, rather than from virgin wood pulp.

Oil is not the only imported material which has an impact on the United States trade deficit and contributes to the current inflationary spiral. Numerous raw materials used in manufacturing processes are imported into the U.S. Many of these raw materials can be found in the solid waste stream and can be recycled to produce an economically attractive domestic supply. Newsprint is one example.

The implementation of newspaper source separation programs similar to the one in Burlington County will help to alleviate U. S. dependence on imported newsprint. At the same time, this effort will also foster the strength and expansion of the recycling industry. This expanding industry will contribute significantly to the New Jersey economy. The proposed recycling program should afford residents an opportunity to participate in the change from a wasteful, throw-away society to a more conserving one.

It is probable that a small number of residents will be reluctant to source separate their newspapers and place them on the curb. Despite the tax-savings benefits derived from a source separation program, the residents may feel as though it is their personal right not to participate. They have the right to refuse participation. During the development of the plan in Burlington County, the possibility of imposed penalties on individuals who refused participation was considered. The original version of the plan did contain an ordinance requiring residents to source separate their newspapers under mandatory enforcement. However, it should be noted that: 1) no enforcement would take place during the first year of the program; 2) if a resident chose to donate his/her newspapers to another organization then he/she would be exempt from the ordinance; 3) if a resident wanted to continue wrapping certain solid wastes in newspapers, the resident would be exempt from the ordinance; 4) the excessive violater was the kind of citizen for whom the penalties were designed. The infrequent violator would have escaped prosecution; 5) physically disabled citizens would not be required to participate.

At first it was thought that mandatory participation was a vital component to the success of the program. It was thought that private contractors bidding for newspaper collection would need assurance that the proposed collection would be a worthwhile business venture. An ordinance mandating source separation participation was thought to guarantee monetary returns. Based on other towns with successful source separation programs, it was found that in cases where newspapers were required by ordinance to be source separated from other household wastes, participation rates were twice as high as compared to those programs using the voluntary approach.

Nevertheless, because of the opposition, the Burlington County Source Separation Program was amended to permit voluntary participation.

What are the attitudes of your parents, friends, neighbors, and community groups concerning the source separation program? You can find out by designing and distributing a questionnaire. This survey may be a class project or an individual project. Formulate a working hypothesis before you begin your research.

1) Basic Information (occupation, age, sex, education level). This information should be requested at the top of the questionnaire. Names are not important.

EXAMPLE:

Occupation:____________________

Age:_____

Sex:___________

Education Level:_____________

Carefully re-read the provided information about the source separation program and condense it into paragraph form. Brevity and clarity are very important. Enough information must be provided so that your questionnaire respondents can answer each item objectively. Six or seven sentences should be enough. Start the questionnaire just below the descriptive paragraph. The number of questions to ask is up to you. However, tabulation difficulty will increase with a large number of questions.

Yes/No responses will be easier to tabulate than responses entailing long wordy phrases and descriptions. Develop your questionnaire so that the responses can be recorded in the right hand margin of the page. This will help to make tabulation easier. When you are distributing and presenting the questionnaire to the public (door to door) you must be sure to introduce yourself and the purpose of the project and who will be reviewing the results. Offer to send them or make available to them the results of the questionnaire. Be sure to answer any questions they may have about the program.

Try to focus your questions on the following themes:

Do the people you speak to...

- *seem aware of the project purpose?*
- *favor mandatory participation or voluntary?*
- *have any interest in solid waste problems?*
- *seem aware of the need for source separation?*
- *seem willing to source separate items other than paper?*

2) Tabulation - *How to collate and evaluate the responses.* After carefully studying the returned questionnaires, you should be able to come to a conclusion about the people you surveyed, and about their thoughts on the source separation program. Try to categorize the responses by age, sex, and education level. Try to establish relationships and correlations between responses and the types of people you questioned. For example; younger people may be more inclined to react favorably to new ideas and may agree to participate more readily in the program. You may, however, find the opposite to be true. The number of people you include in the survey is up to you or to the class. In order to obtain statistically valid data it is helpful to interview as many people as possible. A wide cross-section in age, education, and socio-economic background is also desirable.

3) Summarize and prepare a report. Prepare a tabulation sheet to summarize the results you and the class found. The class should agree upon the form and organization of the tabulation. Select several students or teams to present the version they favor.

Following this, each person should write a three to five page report to include:

1. Reason for conducting the questionnaire.
2. Method of distribution.
3. Public reaction to the questionnaire.
4. A list of interesting and surprising results with your suggestions to account for the results.
5. The summary.
6. Difficulties encountered in conducting the questionnaire and suggestions for modifying the method.
7. Implications for the administration of the source separation program.
8. Changes you would suggest in the program as a result of the questionnaire.
9. Information which you think should be communicated to local public officials.

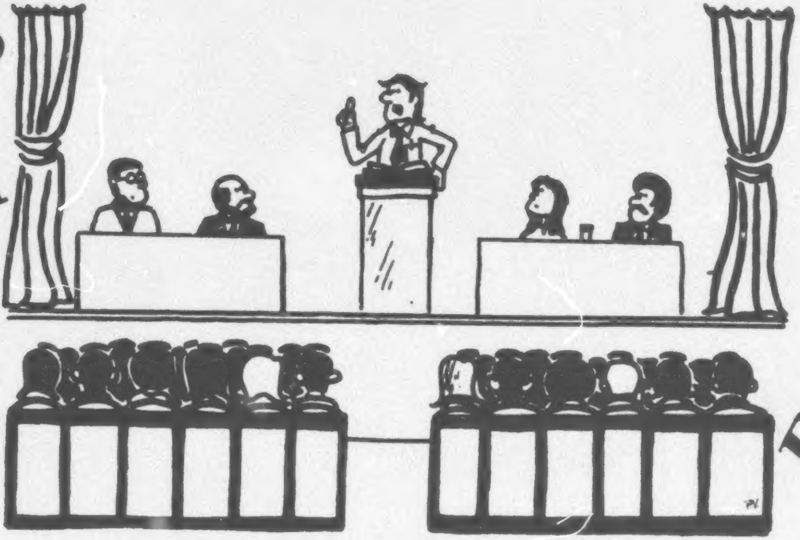
Action taken by EPA to curb pollution by toxic wells

Company president charged with dumping toxic wastes

Freeholders to sue landfill operator

Swimming banned

New recycling rules expected



Recycling advocate turns waste into cash

Recycling Pays Off . . .

But Not Here

Tainted ground water found at dump site

Many water systems contaminated

YOUR JOB IS: To attend a public hearing, public meeting or community gathering on solid wastes problems.

DID YOU READ THESE HEADLINES ON THE COVER PAGE?

"Man Pleads for Kid's Health"
"Ten Victims Tell Panel of Toxic Waste Perils"
"Silent Attack - Chemical-Laden Water Takes Toll"
"Acid Rain Feared"

These above headlines sound as if they might have been generated by the threat of war, the fear of a new drug engulfing the youth of America, or a crisis like the seizure of hostages.

But instead, they are leads to articles about such places as Love Canal, N.Y., Three Mile Island, Pa., Elizabeth, N.J., or Jackson Township, N.J.; places made infamous by the harmful effects of HAZARDOUS WASTES.

"7500 Wells Pump Dangerous Wastes Into Drinking Water"
"D.E.P. Bans Swimming and Fishing in Newark Bay"
"Small Radioactive Air Leak Reported at Nuclear Plant"

These headlines have become regular reading in today's newspapers. So common are they that they may become an afterthought while you go back to reading the entertainment, stock market, sports, or comic sections of your newspaper.

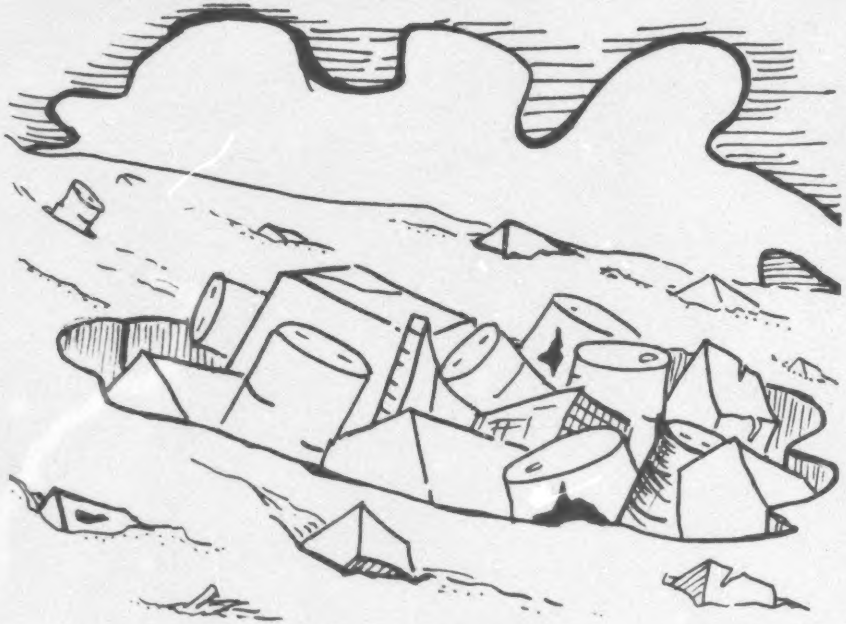
The Toxic/Hazardous Waste Problem

"This is the single most important environmental issue of the 80's.", said 33 year old James G. McCarthy of Jackson Township, N.J., while appearing before a U.S. Senate sub-committee investigating the hazards of chemical wastes stored or dumped in the ground.

McCarthy, who began sobbing at one point during his testimony, said he lost a daughter by toxic waste death and who himself was forced to have a kidney removed because of ill effects produced by chemical dumping that polluted his ground water well supply.

More than 200 families of Love Canal, New York, were relocated around the country at federal expense after their frequent and increasing illnesses were found to be related to the location of their homes on top of or near the Love Canal toxic dump area.

These are but two of many such instances blamed on the dumping of chemical wastes which have occured throughout the United States. As the effects of past chemical waste dumping practices are being realized, there is little comfort in knowing there are an estimated 290,000 active generators of toxic wastes and an estimated 30,000 legal and illegal toxic waste dump sites throughout the United States.



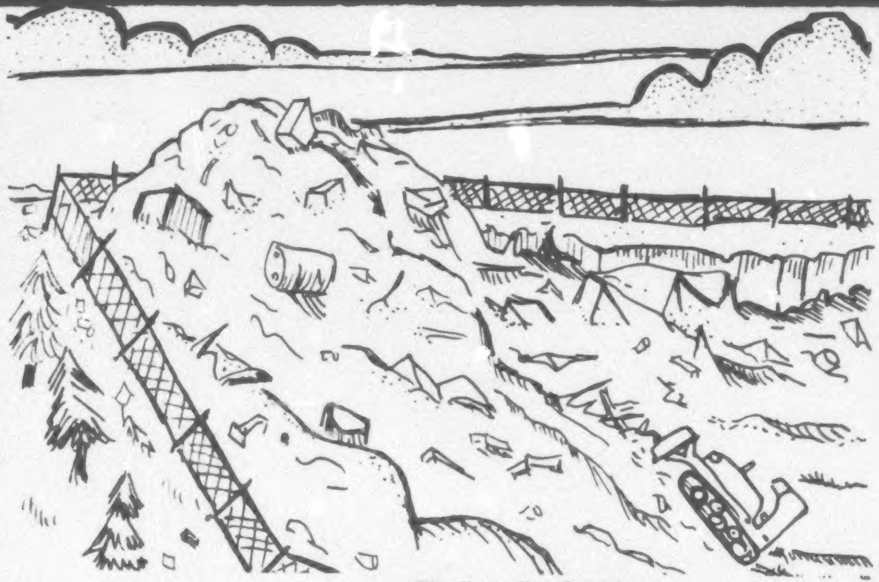
The Scarcity of Landfill Sites

As pressing as the problem of chemical waste is, the same holds true in finding suitable answers for our increasing volume of solid waste.

"Landfill Closing Leaves Few Options for Solid Waste Disposal"
"Judge Orders Landfill Closed, Cites Pollution"
"Dumping Activities Probed"
"Land Suitable for Landfills Scarce"

If you saw the above headlines in your newspaper, would you be inclined to continue reading the article? If you said , "Yes", you might be in the minority. Most people's knowledge of their household wastes ends the moment they set the trash out to be collected. The unpleasantness of gathering your trash and carrying it to a designated pick-up spot is not relieved by knowing that it will be a week before such action is required again. Unfortunately, it is only the small beginning of the problem.

New Jersey generated 6.2 million tons of municipal waste in 1980. That figure is increasing at an alarming rate each year. To compound the problem of increased production of solid waste, New Jersey now has 100 fewer landfills than the 1970 count of 320. Using statewide averages, it is estimated that New Jersey only has four years of landfill space remaining. Land suitable for construction of new sanitary landfills is very scarce, and many operating landfills are being threatened with closure due to problems of toxic leachate, methane gas, the growth of sprawling suburban neighborhoods, poor management, and by natural death of the landfill (life expectancy completed after being entirely filled). So...what are the answers?



The Recycling Question

"State to Unveil a Wide-ranging Recycling Plan"

"Trash Separation Ordinance Approved"

"Recycling Drive in Infancy, But Growing"

"Reclamation Center Gross Tops $500,000"

In 1980, 0.5 million tons of paper, glass and metal cans were recycled in New Jersey. Also limited amounts of motor oil, food waste, tires, plastics, and yard wastes have been recycled or re-used throughout the state.

By 1986, New Jersey hopes to: 1) increase the source separation and recycling of glass, metal, and paper from the 1980 estimates of 0.5 million tons to 1.3 million tons of these materials annually, 2) increase recycling of used motor oil to 18 million gallons per year and, 3) increase recycling of food waste, tires, plastic, and backyard waste to 0.5 million tons per year.

If the 1986 recycling goals are met it will decrease the amount of solid wastes going to our landfills by twenty-five percent. This will help increase the life expectancy of our landfills, giving us more time to search for more efficient solid waste disposal methods.

Recycling efforts will also result in the saving of limited renewable virgin natural resources such as forests and timber.

It is estimated that 150 acres of trees are required to produce a single day's printing of the Sunday New York Times. If you recycled a stack of newspapers 36 inches high (about 100 pounds) you could save one tree.

By recycling, you can save energy. It takes less energy to recycle waste material into usable products than it does to convert virgin natural resources into the same product. Reaching the hoped for 1986 recycling figures would help reduce New Jersey's energy consumption by the equivalent of 1.9 million barrels of oil per year.

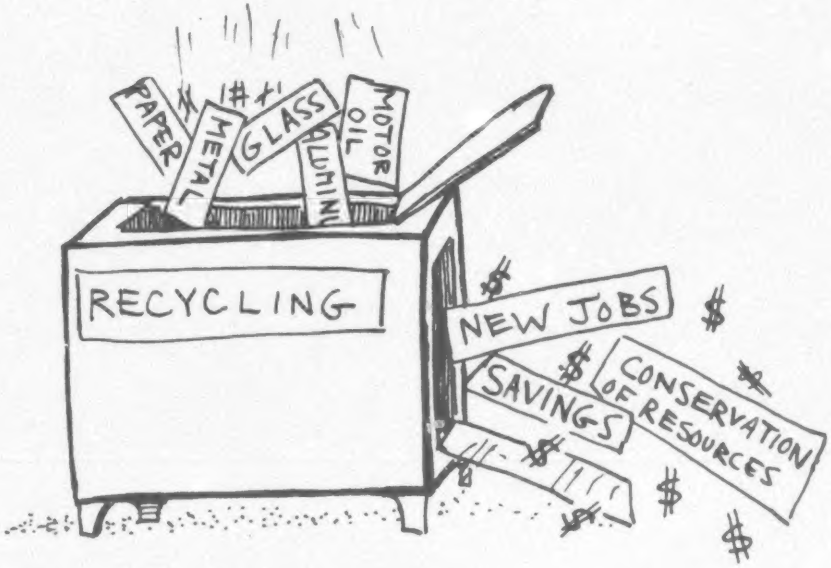
BEGIN HERE: We have pointed out three topics of current interest your class may wish to learn more about: 1) Hazardous/toxic waste 2) Landfills 3) Source separation/recycling. Select one or more which your class wishes to investigate.

WHERE'S THE HEARING?: Your municipal or county office can inform you of any forthcoming; 1) Public hearings 2) Public meetings, or 3) Informational meetings dealing with these topics. You can also find public hearings listed near the classified section of most newspapers.

GETTING PREPARED: Collect information to have a class discussion on the subject your class chose. This discussion will let you see exactly what you do know and what areas require further researching.

Go to the school or public library. Read as many books or pamphlets on your subject as you can find. Use the Reader's Guide to Periodical Literature.

Your public library may have a newspaper file. Look through the copies of old news papers for any articles about your subject. If you can, make a copy of these articles for a file in your classroom. If not, send a committee of two or three to your nearest local or area newspaper to research the files. It should have a file of clippings called a morgue.



Contact members of the different organizations as well as town or city officials that will be appearing at the hearing/meeting. Get their views on your subject. Have a class discussion after the information has been gathered by your class.

A) Discuss what aspects of your topic you feel will have more importance at the hearing or what you feel will be discussed.
B) What your class would like to hear discussed at the meeting.
C) A series of questions should be written with questions pertaining to aspects your class wants to know more about or what issues they will discuss.
D) Discuss as a class what you think the outcome of the hearings might be.

AT THE HEARING:

A) Your whole class is welcome to attend any of the hearings or meetings.
B) Choose 1 or 2 classmates as designated spokespersons if any questions are to be asked by your class.
C) The remainder of the class may take notes.
D) A tape recorder may be of help if permission to operate one during the hearing/meeting is given.

BACK IN CLASS:

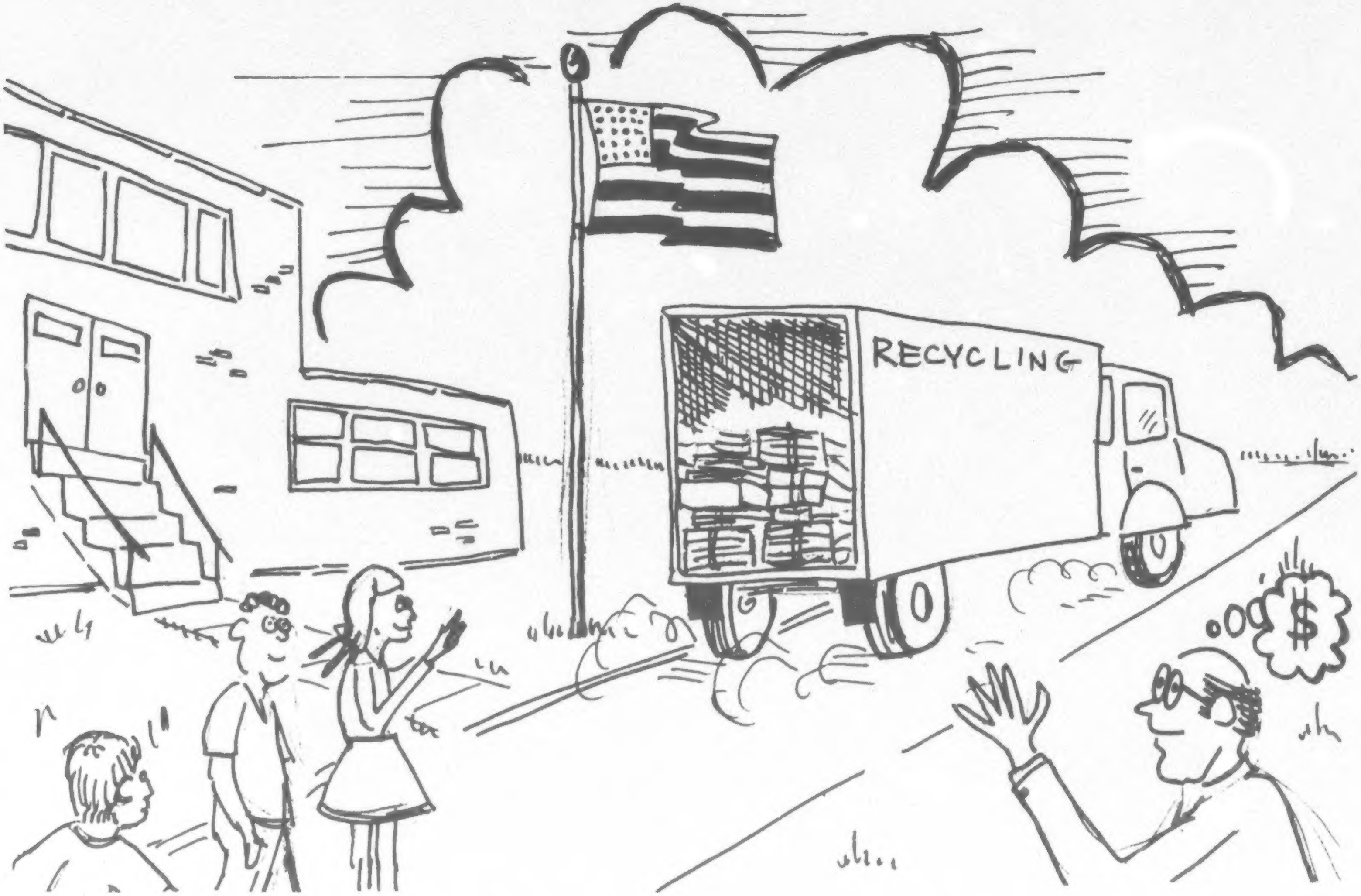
1) Discuss in class what new information has been gained on your subject after attending a public hearing/meeting.
A) Did the hearing go as you expected?
B) Did you feel the hearing had any significant value?
C) If your class tried to present a differing viewpoint, were your ideas well received?
D) What changes, if any, do you feel will come about because of the public hearing/meeting?
E) A concluding discussion on possible or desirable alternatives is a good ending for your class discussions about the hearing(s).

ON YOUR OWN: As a class, you may wish to have a hearing or meeting on the subject(s) of the hearing(s) your class chose to attend. Challenge any other class to participate in a debate on your subject.

Maybe setting up a meeting/hearing at your school would help inform your neighbors about problems dealing with solid waste. If you decide to do this:

1) You will first have to get permission to use the school auditorium.
2) Contact community officials. Find out what problems the community officials think would be beneficial to your neighbors if you were to conduct a meeting at the school.
3) Invite community officials and organizations with differing viewpoints concerning the problem considered at the hearing.
4) Prepare a report which your designated spokesperson will present at the hearing. This report should reflect your class's opinion on the subject chosen.
5) If the subject your class chose for the meeting/hearing in the school is different from the subject discussed in the original public hearing, follow the steps within this lesson to research the new subject.
6) Inform your neighbors and fellow students about the hearing. Make posters and put them up around your school and neighborhood. Display the posters at least 2 weeks before the hearing/meeting.

CCESC
CETA
10-12



Paper and paper products make up a large percent of the waste disposed of in our nation's sanitary landfills. This practice results in huge waste of reclaimable natural resources. *As much as seventy percent of this wasted paper can be recycled into useful products.*

Why Recycle?

Our consciousness concerning the need for recycling programs was raised considerably ever since the first Earth Day on April 22, 1970. Family station wagons began hauling newspapers to recycling centers, college students wore buttons and hung posters encouraging citizens to protect the environment, high school groups organized trash collection outings on the nation's highways, and environmental magazines and newsletters broke into print almost overnight. A new movement - the environmental movement - was underway.

But was it really a new movement? Certainly recycling activities were not new; they had been forgotten or ignored. The Salvation Army founded in 1865 by William Booth in London, England, has been in the business of collecting, separating and recycling waste for nearly a hundred years. The Salvation Army's initial resource recovery activities in the United States were started in New York City during the 1890's.

In 1896, in New York City, Colonel George E. Waring Jr., initiated a system of primary separation which required householders to store organic wastes, paper and other light rubbish, ashes and street sweepings in separate containers for collection.

In the United States, the Waste Reclamation Service was created in 1917 due to the severe shortages of raw materials during World War I. The notion underlying the creation of this new agency was that every article of waste had some valuable use and that it was necessary to organize and coordinate the processes of separation, collection and recovery to secure materials for reuse in industry.

This practice has been resurrected in some measure during each succeeding war. This was needed not only because raw materials became scarce, but also because of the wastefulness practiced by Americans during times of peace.

Remember also that the Boy Scouts of America have been practicing resource recovery since 1942. In addition to private contributions, the profits made from the collection and selling of waste material to the various recycling centers has helped to support the programs of the Boy Scouts of America.

Fact - In a retirement city, Sun City, Arizona, a group of six Lion's Clubs has banded together to operate a collection program for the community's 55,000 residents. These Lion's Clubs earn more than $8,000 per month, which goes to support local and national charities, as well as to finance Lion's Clubs group activities.

Fact - In Marlton, New Jersey, a small group of church members collects newspapers and sells them to recycling centers. With their profits this group goes on field trips to Boston and other places of interest in the Northeastern United States.

Fact - In Point Pleasant, New Jersey, an older citizen, Jack Glass, has coordinated and participated daily in a recycling effort for the Boro aided by volunteers from the Boy Scouts and intermediate school youngsters. He and his group have sold their recyclables for more than $1,500 a year. Their profits are used for educational trip activities for the youngsters involved.

Fact - Many schools and civic groups have made their recycling programs work and show a profit.

In 1978, almost 16.7 million tons of waste paper were kept separate from other wastes and collected for recycling. Most of this material consisted of: old newspaper, corrugated boxes, and mixed office and high grade waste paper (clippings and cuttings from factories making paper products). This added up to 24% of the total paper and paperboard that was actually consumed in the United States. About 14.8 million tons became new paper and paperboard products. Another 290,000 tons of waste paper were also used in this country to make products such as insulation, packing and cushioning materials and also building products. Finally, 1.6 million tons of waste paper were exported to be used as a raw material by recycling mills in other countries.

Eighty-five percent of the wastes generated in an average high school is either paper or a paper product. Your school may spend approximately $10,000 for paper in one school year. This does not include the money you spend on notebooks and other supplies. Much of this paper is needlessly wasted. Your school may use as much as 20,000 pounds (10 tons) of paper in one school year.

With hard white-lined waste paper going for $300 per ton (1980's average), and some waste paper of a lesser quality going for $120 per ton (1980's average), it is possible to save your school as much as $3,000 or add a similar amount to your class treasury each school year. Of course, that figure depends on many variables. To reach the figure of $3,000, you would have to deal with clean hard white-lined waste paper only. The price you get for your waste paper also depends on: the fluctuation of supply and demand, how the paper is sorted and bundled, and the cost of transporting the waste paper to the various waste paper companies.

By source separating (separating reusable and recyclable solid waste before they are collected and mixed together) your school's waste, and taking the waste paper to a recycling center, you're not only saving local taxpayers money, but you will also be participating in sound conservation measures. A recycling operation in your school can help reduce: 1) air pollution - paper will not have to be burned in an incinerator, 2) the solid waste load going to the landfill, therefore increasing the life expectancy of the local landfill, 3) unnecessary consumption of virgin natural resources (trees).

YOUR JOB IS:

To initiate a paper recycling operation in your school. If your school officials do not allow you to start a recycling operation, you may wish to research your school's paper consumption. Follow the procedures outlined under "What to Look For" in this Lesson. LET'S GO ! !

Step 1. Get Permission.

Most important, you must get permission from your school officials to start a recycling program. Your school officials will also be helpful providing adequate storage space for your waste paper. Be sure to check health and safety regulations concerning the storage of waste paper.

Once permission is granted, your class may want to set a goal for your recycling funds. For example, your recycling center could start out as a fund raiser for a school beautification program.

Step 2. Find the Right Dealer.

Before starting a recycling program, contact a couple of waste paper dealers in your area. Dealers are listed in the yellow pages under "Waste Paper". You will need to find out:

A) Which dealers will accept the type of waste paper your school generates?

B) How much they will pay for your waste paper?

C) How should paper be sorted, bundled and delivered?

D) Do they pick up or do we deliver?

It is important to establish a good relationship with your waste paper dealer. That person can provide valuable assistance in organizing your program and you might be able to arrange a long term agreement with him for your waste paper.

Step 3. Get Everybody In On It.

Encouraging the participation of the school maintenance staff, your principal, the teachers, and fellow students is important.

You will need 2 or 3 cardboard boxes along with the trash can in each classroom in your school. You may need extras for the lunchroom, art labs and school office. Label each cardboard box according to what type paper is to be deposited in the box. Your waste paper dealer should provide information as to what kinds of paper should be kept separate from other kinds of waste paper. Instruct each class about your recycling program and what each box is for. Make it very clear that non-paper wastes, (food, scraps, pins, pencils, metal) are not to be put in any of the cardboard boxes. The cleaner the paper the higher the profits.

Step 4. Deputize.

Assign each member of your class a number of classrooms. That person is responsible for collecting the waste paper in the assigned classrooms and transporting the paper to the central holding stations. When you leave the paper at the holding station, make sure you put the paper in the proper piles. Make sure you have regular pickups in each class (at least once a week). If the waste paper is allowed to pile up, some people may complain and your recycling program may be halted.

Step 5. Analyze the Operation.

You should be ready to start earning money from your collection efforts. For this step your waste paper dealer should provide any answers to any questions you might have. You will need to know:

A) How much paper in pounds should you have before taking the waste paper to the dealer?

B) How should the paper be sorted?

C) How should the paper be bundled?

D) Will the dealer provide his own pickups?

It is usually cheaper if you arrange for a parent or classmate to deliver the waste paper. You may pay that person gas money from the profits made from the waste paper. If a neighboring community has a contractor picking up paper, you may be able to save mileage by making arrangements with the contractor on pick up day.

In order to find out how much money you have saved your school by recycling the school's waste paper, the principal can play an important role. Ask the principal if you may see the school's purchase order form for the supplies they bought for the school year. You will have to go over this purchase form and compute the amounts they paid for the different types of paper your school uses. At the end of the school year, find the net recycling yield by subtracting the amount of money your recycling program made from the amount of money the school board paid for paper.

What To Look For:

A) The amount of paper bought and the cost. This includes paper for classroom and office use as well as wrappings of all kinds.

B) The different types of paper.

C) The amount of paper consumed.

D) The amount of paper not consumed.

E) The difference in money saved from purchase price figured by subtracting cost of remaining paper supply.

F) The profits made from recycling the amounts of paper used.

G) The savings.

H) Report your findings to school officials or school board members.

Continue this operation until the end of the school year.

CAN YOU DO THESE?

Starting a paper recycling program in your school can take care of about 85% of the waste generated in your school. Can you think of any way the remaining 15% of waste can be recycled or re-used? A little hint; the food scraps from the cafeteria can be given or sold to hog farmers. Can you think of any other uses for the remaining 15% of trash or garbage?

SCHOOL RECYCLING PROJECT

ON YOUR OWN:

If your class is not interested in starting a recycling operation in school, maybe school officials will allow you and interested students from other classes to start a recycling program. Follow the steps within this lesson.

If your class has started a recycling operation and profits have been made maybe you would like to try and get your community interested, if they don't already have a recycling program. Contact community officials. Get their views on recycling. Explain to them the success your school's recycling program has accomplished and what a recycling operation can mean to the community.

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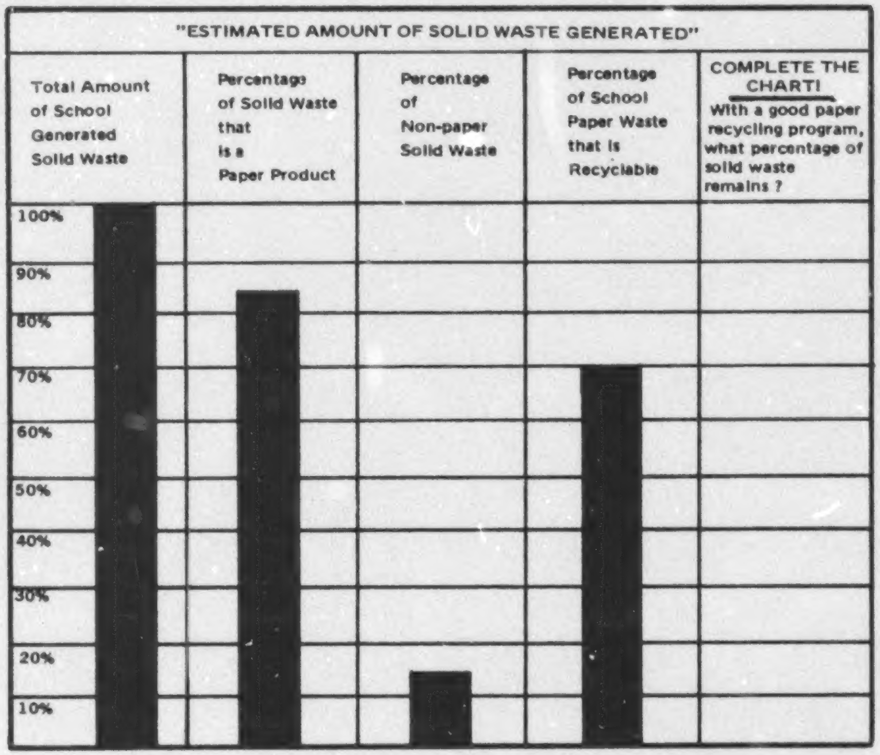
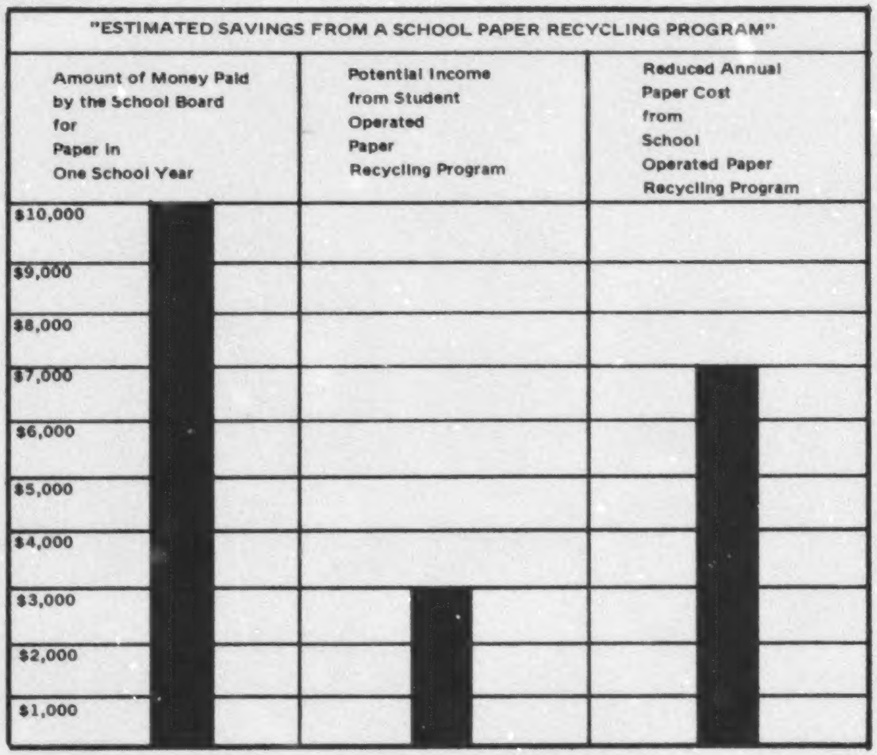


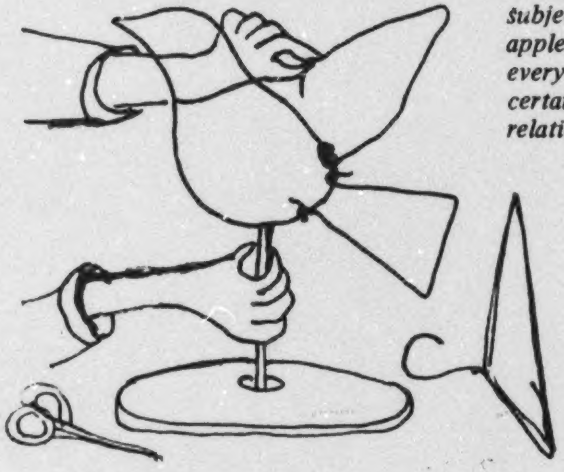


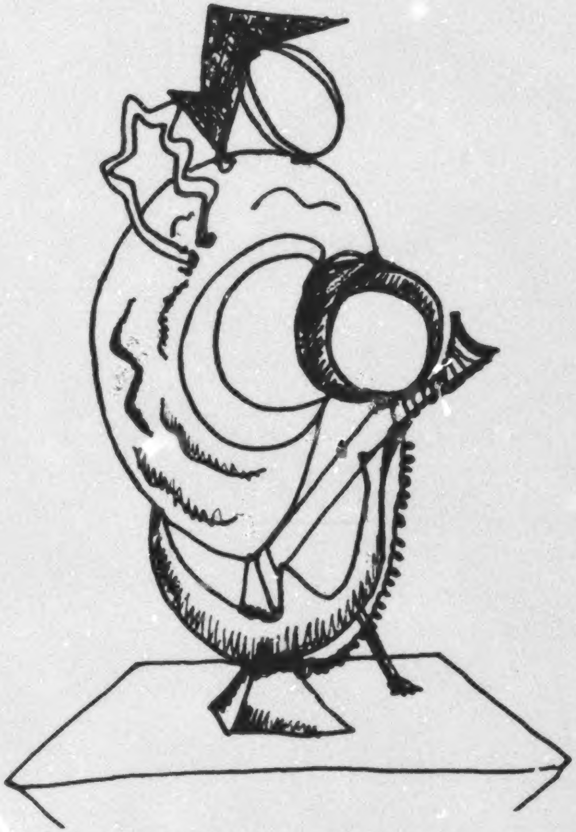
"I like to work from things that I see, whether they're man-made or natural or a combination of the two. Once in a while I work directly from something I've seen, like a window, or a fragment of a piece of architecture, or someone's leg..."

Ellsworth Kelly

"Painters don't 'come upon' subjects for a still-life; the Impressionists didn't come upon their subjects. They found their trees; they chose their apples; those are all 'found objects' - flowers, fruit, everything. I find many things, but I only choose certain ones that fit a niche in my mind, fit into a relationship I need..."

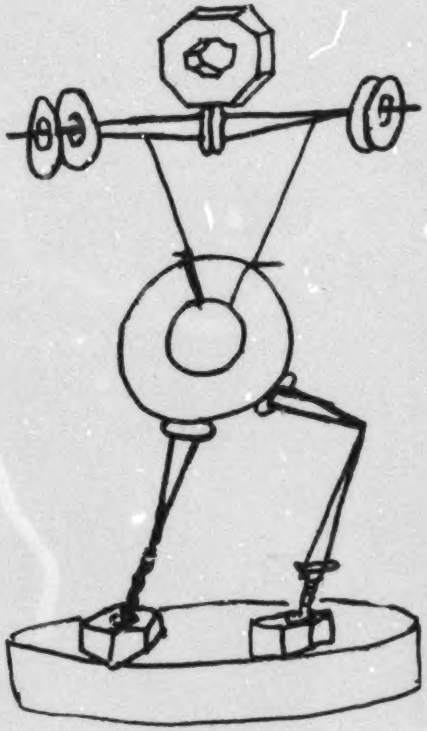
Thomas B. Hess





Americans, over the past century, have become extremely wasteful. Products that are made from the earth's diminishing natural resources are simply "tossed in the can and dumped" without being given further consideration. This is both an environmentally unsound and a highly expensive habit that we have accepted as normal for so long. It seems time to take a lesson from nature and begin to recycle our wastes.

The successful recycling or reuse of solid wastes depends upon our ability to view our wastes through more imaginative eyes; eyes that see solid waste as a resource waiting to be tapped. In the following activity you will be tapping that resource. You will be creating something new and culturally significant from objects that were once considered useless pieces of junk.

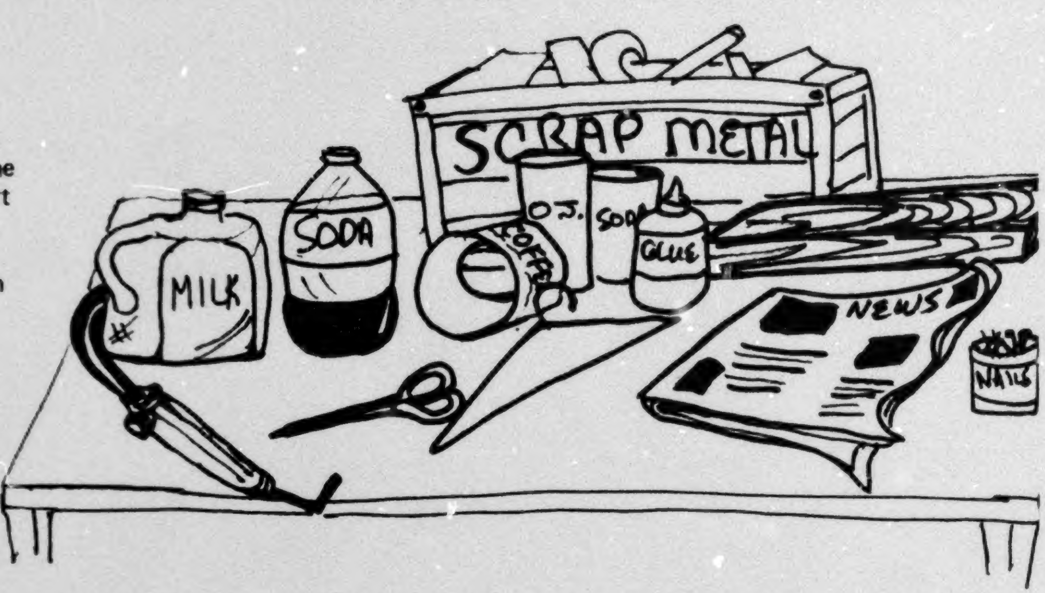


ART AS A LANGUAGE

Art is a means by which one may organize an experience of his or her own into an ordered form which can then "come to life again" in the creative imagination of other people. Art is a language.

From the beginnings of human existence man has used sculpture as a means of recording experiences that range from natural disasters to natural beauty.

Sculptural assemblage is the creation of art objects by connecting various materials together. These materials are often pieces of junk and solid waste. The making of "junk sculpture" or "sculptural assemblage" may be undertaken as a very serious act of creation or design, or it may be approached lightly, with tongue-in-cheek. Either way it allows an opportunity for self-expression.



TRADITIONAL SCULPTURE

A sculpture is a work of art that has dimension, height, width and thickness. It exists in three dimensional space. The empty space the sculpture defines is just as important as the solid form of the sculpture. Sculpture has been defined as the logical or pleasing organization of forms and volumes utilizing design principles including unity, rhythm, and balance.

Traditionally, sculpture has been divided into modeling and carving. That which is modeled is additive and that which is carved is subtractive.

Modeling is called an additive process of sculpturing because material can be added, shaped or removed until the deisred form is achieved. The modeler uses soft, plastic material such as clay or wet plaster.

Carving is called a subtractive process of sculpturing because material is taken away to create a three dimensional form. The carver works a block of hard material, usually wood or stone, with a chisel and mallet. The artist must work slowly and cautiously to chip away all excess material until the desired form is obtained.

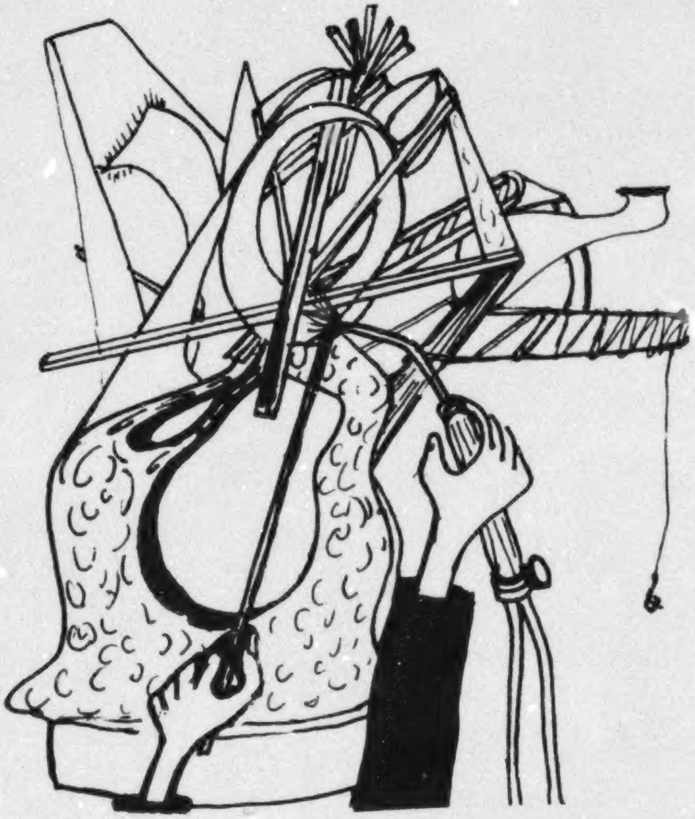
A REFLECTION OF HUMAN EXPERIENCE

Art has often been called a "reflection of human experience". Artists reflect personal experiences, events and cultural attitudes in their work. More recently, artists have been greatly influenced by technological and industrial innovations which have dramatically changed our style and standard of living. Many artists today tend to choose materials that reflect and represent modern technology. Sculptural assemblage allows the artist to incorporate traditional sculptural techniques as well as the products of modern technology in his or her work.

Many artists in recent times have become very interested and attracted towards the use of solid waste as a media form. Famous works from the 1930's and 1940's were created out of butterfly wings, tobacco leaves, metal foil, driftwood, dirt and various other discarded and seemingly worthless items. Today's artists can utilize materials like plastic, aluminum, various discarded wood products, steel and many other synthetic items.

GETTING STARTED !

You have learned a little about some of the materials that artists have used in the past. Now you are the artist. Choose the materials you wish to include in your assemblage. Be selective; you have an unlimited supply of objects to choose for your design. Be creative; the emphasis is on your ideas and innovative skills. Remember, the object of this project is to reuse and recycle solid waste materials with the conservation ethic in mind.



METHOD OF ATTACHMENT

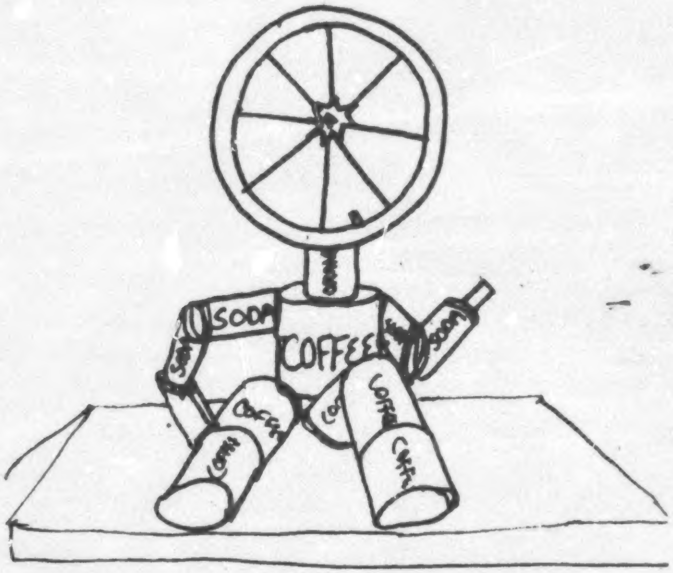
Each artist must search for the type of attachment that is best suited to the materials used in the assemblage. You may want to use the chart below as a helpful guide.

Material used	Weld	Solder	Braze	Superadhesives	screw
Heavy Metal	✓				
Light Metal		✓		✓	
Metal Wire		✓		✓	
Brass Objects			✓		
Wood				✓	✓
Plastic				✓	
Paper				✓	
Glass				✓	
Rubber				✓	

Trial and error may prove to be the best means of determining the proper method of attachment for your assemblage.

HAVE FUN !

This activity will hopefully prove to be both enjoyable and enlightening. For those of you who have never attempted to create a piece of artwork, this lesson will provide you with an opportunity to express your imagination, originality, and artistic skills. If your school holds an annual art show, don't be afraid to enter and display your creation. Remember---"beauty is in the eye of the beholder". Who knows; maybe the "beholder" will be so impressed by your creativity that he or she may want to buy it from you or contract with you to do more projects! Whether or not you win an art contest, sell your work, or become famous, the important thing is that you have created something from materials that were once considered useless by-products of our wasteful society. You have conserved valuable materials, saved space in sanitary landfills, and contributed to a change from a wasteful culture to a conserving one.



FOR FURTHER INFORMATION

GO TO THE:

- Philadelphia Art Museum
  1st floor, section 6, Contemporary Gallery
  See the Bird Lover in the Grass,
  by Richard Stankiewicz
  This sculpture was created from metal scraps.
  ADDRESS:
  Ben Franklin Parkway & 26th Street
  Philadelphia, PA
  (215) 763-8100

- Modern Museum of Art
  3rd floor, Gallery 3
  Ask to see the Piccasso Works.
  ADDRESS:
  11 West 53rd Street
  New York, NY
  (212) 956-6100

WRITE TO:

- Sculptures Guild Inc.
  797 Madison Ave.
  New York, NY 10021
  (212) 628-6278

READ:

- Contemporary Sculpture Techniques
  by John Baldwin
  This book offers step-by-step, clearly explained directions for welding, brazing, and cutting metals.

- American Sculpture of the Sixties
  Distributed by New York Graphic South Ltd.
  Ideas and color pictures of what others have created.

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